
The **future** of **video**gaming

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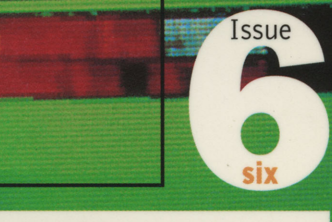
EDGE

SNES ■ Amiga CD32 ■ Mega Drive ■ PC ■ CD-i ■ PC Engine ■ Neo-Geo ■ 3DO ■ Jaguar

The 3D race is on

The next generation of videogames will take place in the 3D realm. Enter another dimension with **Edge...**

Issue 6 six



Voted **magazine of the year** by the **videogame industry**



Namco's stunning *Ridge Racer* coin-op shows what the latest hardware can do – and next year, you'll be playing it on Sony's PS-X home console. We preview the coin-op on p22 and explain how 3D graphics are produced on p38...







The videogame is dead… Long live the gamevideo

The videogame has out-evolved itself.

There is already a distinct difference between the gameplay of a few years ago and the experiences generated by today's aesthetic tours-de-force.

With the old 8bit systems, there was little in the way of clever graphics and sound to draw in the player, so they had to rely on gameplay – that indescribable, intangible element that made it *fun*.

But as games – if they can still be referred to as that – have grown in size, complexity and vision, the gameplay element is now secondary to the atmosphere and involvement.

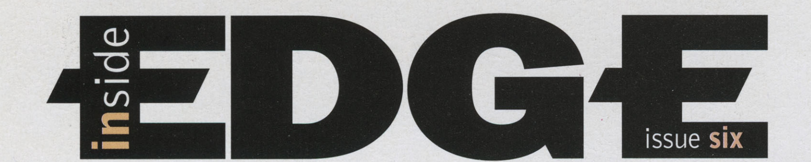
This is no side-effect of natural selection, but the result of the uncontrolled actions of programmers and designers. With the capacity to show fantastic images and produce stunning sound, the apportioning of energy and effort has shifted from the mechanics of gameplay to the presentation and creation of a 'gameplaying experience'.

Rebel Assault is an excellent example: so far, the closest thing to actually taking part in a Star Wars movie; yet lacking in enjoyable gameplay. And the same with *Microcosm*, or *Voyeur*, or *The 7th Guest*.

'Classic' games such as *Tetris*, *Super Mario*, *Asteroids*, even newer titles like *Street Fighter II* rely on the skills of response, reaction and coordination. Whereas latterday games – especially ones given the 'freedom' of CD storage – rely on visuals an aurals to pull you in, and then simply use gameplay as a means of taking you from one scene to another.

The next step must be to merge the classical gameplay elements that made those simple old games so enjoyable, with the exquisite sound and graphics of today's games. Then that *would* be something…

The **future** is almost here…



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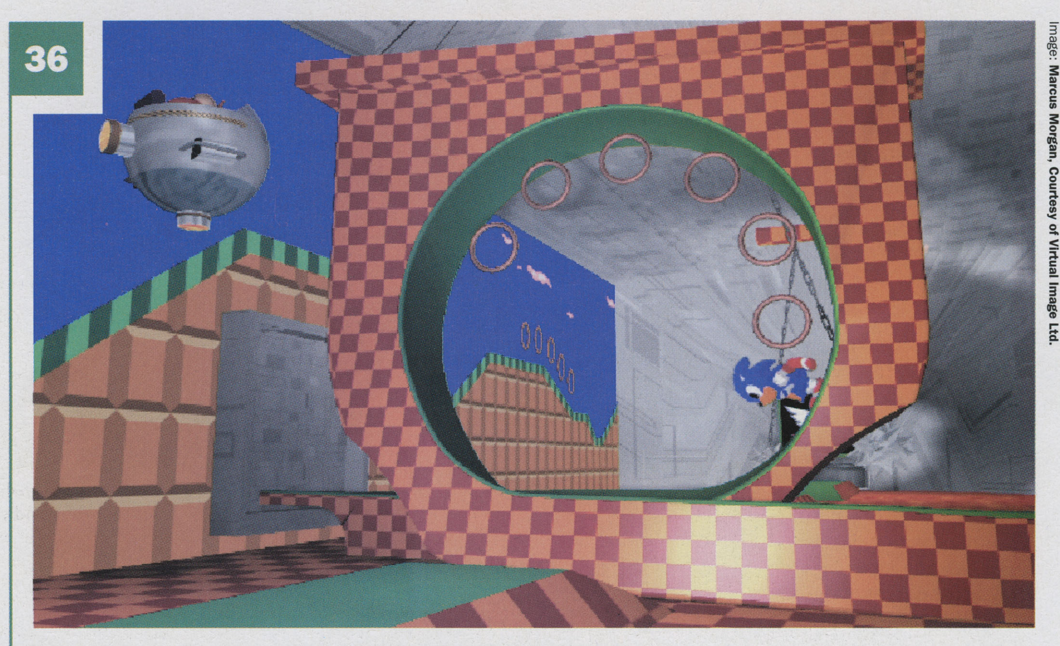
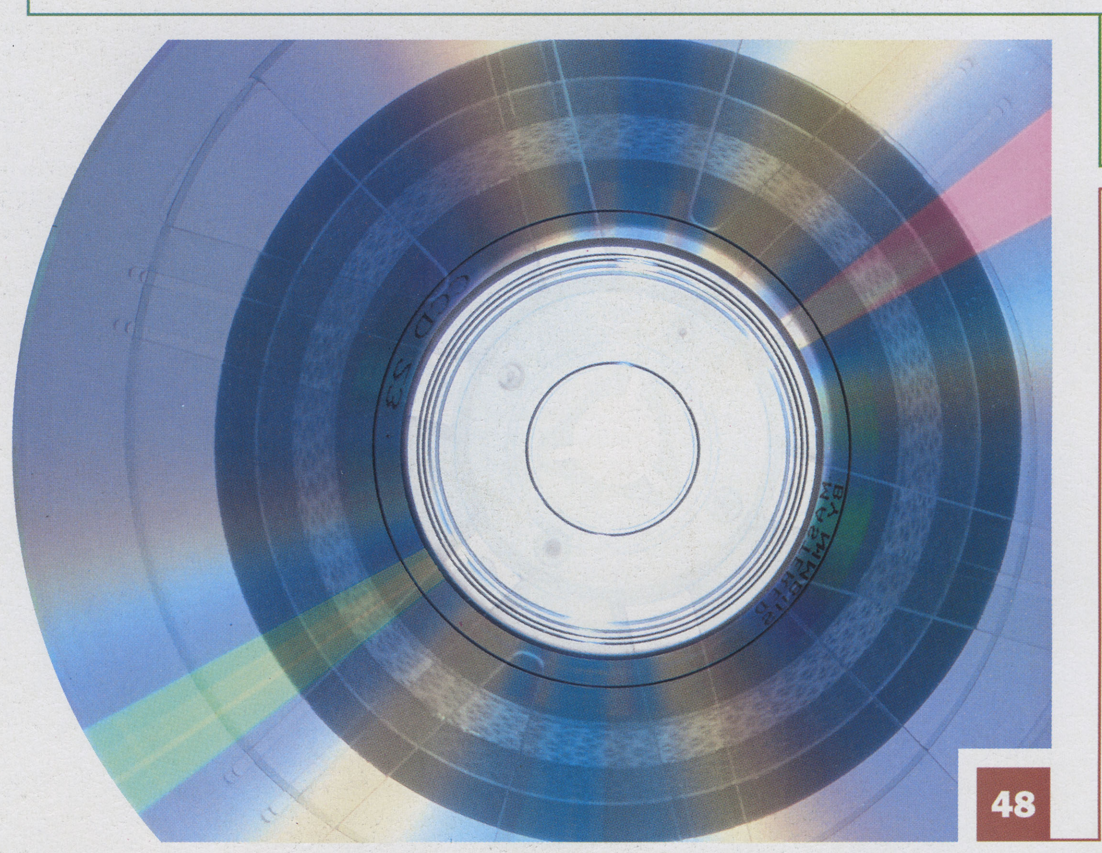


Image: Marcus Morgan, Courtesy of Virtual Image Ltd.

3D: Games in another **dimension**

With the imminent arrival of dedicated 3D graphics machines like Sony's PS-X and Sega's Saturn, 3D chic is back in vogue. **Edge** examines the 3D genre and explains the technicalities of building worlds in the third dimension; followed by a description of the hardware that's becoming de rigeur for videogame production



FMV

Full Motion Video has the whole videogame industry buzzing with anticipation – but how does it work? And just what is the potential for FMV in the CD titles of tomorrow? **Edge** explores the intricacies of MPEG encoding, data bandwidths and quad-density disc drives, and talks to the industry about the future of FMV

insideview

6 News

This month **Edge** hauled ass to the CES in Las Vegas for the latest info on Sega's Saturn, Nintendo's Project Reality and all the very best new game releases. We also have exclusive details on a brand new PC-compatible coin-op, Sony's recent developers' conference and the Virtual Reality systems unveiled at the IAAPA show in Los Angeles





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Prescreen

Edge has all the major releases from the Las Vegas CES, plus in-depth looks at the *Ridge Racer* coin-op, and the grisly excellence of *Doom* (above)



56

Testscreen

Including the world exclusive on 3DO *Total Eclipse*; plus sequel mania: *Ganbare Goemon 2*, *Mortal Kombat 2* and *Alone In The Dark 2* (above)



Photograph: Rob Scott

82

Archer MacLean

The sole author of such classics as *Dropzone*, *IK+* and *Jimmy White's Snooker*, Archer MacLean is probably the last bastion of the one-man programming team. **Edge** queried him on his work past and present, and on the advent of the new super-consoles

Sega Saturn and **Project Reality** at CES: full show report, **page 6...** Latest **3DO** releases at CES **page 8... Sony PS-X:** developers preview Sony's 'awesome' new console, **page 12... Arcade** conversions for **PC games**, **page 14... Virtual Reality** news from IAAPA, **page 15**



The very latest **news** from across the entire world of videogaming

Winter CES '94: the main event


Edge's pyramidal award, looking very posh indeed



Another six months means another Consumer Electronics Show. Edge braved the crowds in sunny Las Vegas

Las Vegas' Convention Center (left) was bursting at the seams this year. Sega's stand (above) had Sonic 3 and a few other surprises...

Three cheers for Edge

After only four issues, the videogames industry has voted Edge 'Magazine Of The Year', in the face of competition from not only UK games magazines, but a whole host of European titles too.

As everyone knows, though, laurels are for sticking up on the shelf, not resting on. Here's to an even better '94...

Attendance numbers shot through the roof. Stands grew to immense proportions. Once again the videogames industry out-consumed every other sector of consumer electronics. This was the Winter Consumer Electronics Show which took place between the 6th and 9th of January in the voracious expanses of the Las Vegas Convention Center.

For the most part, this winter's show reflected the recent changes in the industry. For Sega, it meant another marginal victory over Nintendo, but then you needed to look hard for proof. And Nintendo's stand was so spacious that it emitted a strangely muted atmosphere. Both Japanese giants once again played their cards with a depressing predictability. Big games were on display in the form of *Virtua Racing* and *Stunt Race FX*, but to the more discerning eye, 16bit technology looked for the first time like it was outstaying its welcome.

The PC and 3DO, and to a much lesser extent, Jaguar did their best to eclipse the abilities of Genesis and SNES, with the division between the sophisticated games machine and the toy market ever widening.

Of course, Sega and Nintendo's future →



You can forget the artists' impressions – this is it

Sega's huge video wall in true 32bit splendour. Saturn was far from being announced but a crafty video contained some stunning demos of what the beast can do



What is it?

It's a 32bit multimedia system, running on a custom designed chipset called the Slipstream ASIC. It can handle 100 million pixels per second. It loads games from CD, supports full-motion video and has a karaoke function built-in



hardware plans were bubbling under if you looked hard enough. After all, both had to convince their respective cynics that *they* were driving the bus marked 'next generation'.

And lots of people were only too happy to speculate on their individual efforts. Nintendo rather half-heartedly put on some familiar demonstrations of Silicon Graphics hardware, while Sega had a far more canny approach, sneaking out glimpses of their eagerly awaited Saturn system onto the trade floor – with all but the most observant attendees missing them completely.

On a huge video wall, a looping promo video showed a bullish actor waxing lyrical about all things Sega. First, he enthused about Genesis and Sega CD software, then qualified how Sega 'virtually owned the hi-tech arcade market' with an ultra-brief demonstration of their forthcoming *Ridge Racer* beater, *Daytona*. A minute later, we were suddenly streamed a collection of demos from five Saturn games which darted around the multi-screen wall. This whole scatter gun of images climaxed with the prototype Saturn hardware scaling into view, as our friend looked up to the heavens before whispering 'Saturn' in our shell-likes. It was like the coming of the Messiah, Sega-style.

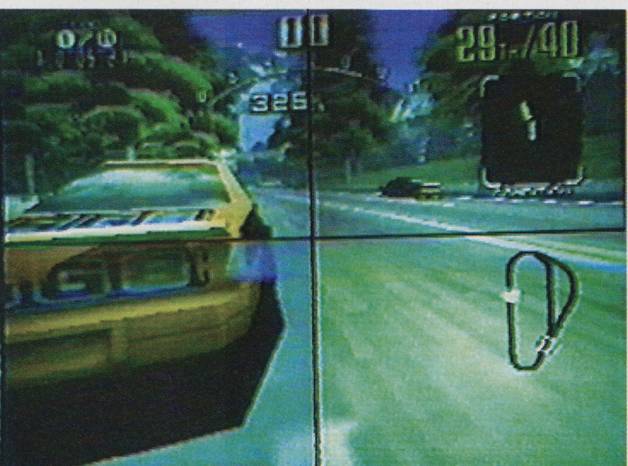
However, all this in-yer-face Sega bravado didn't change the fact that for the next six months, Sega obviously want to keep Saturn firmly at gossip and rumour level. No other details on the system were distributed at the show – Sega's reluctance to overshadow the hugely milkable 16bit market was all too clear. This was simply an appetite-whetting exercise for the industry.

'Saturn does what Nintendon't', or something to that effect. In fact, all our man revealed about Saturn was that it was coming out this fall in Japan. On an official level Sega were keeping schtum.

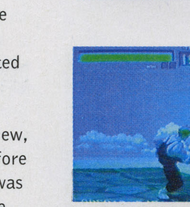


But what about the games that were shown? First up, and rumoured by some to be the first game for the system, was a 3D action game with the player flying on the back of a winged dragon down a texture-mapped 3D ravine. Strangely enough, a similar game was being demonstrated on the Silicon Graphics stand, although Nintendo's amazing graphic demo relied upon a huge $100,000 Silicon Graphics workstation – the Onyx Reality².

The other Saturn games included a version of *Virtua Fighters*, which perhaps unsurprisingly looked identical to the



Three Saturn games courtesy of the Edge paparazzo. (From the top) An unusual platform game with great animation and photorealistic backdrops; *Virtua Soccer*, with great perspectives; and lastly shots from the truly mindblowing racer, *Daytona* (above). Roll on Autumn





Virtua Fighters **(top) looked identical on Saturn, but an amazing canyon ride on the back of a winged dragon (above) was even better**

Continued next page





coin-op. And *Virtua Soccer*, which was an original football game using the same kind of spectacular polygons and imaginative 'camera' angles. Next, an extraordinary platform game entranced the spectators with its rotoscoped animation. But it was easily the *Daytona* racing game that impressed the most – if this was really Saturn in action then players are likely to be astonished with the finished system. Ultra fast, texture-mapped polygons like these are more the hallmark of Sega's proprietary 'model 2' arcade board (model 1 runs *Virtua Racing*). And there's no doubt that this collection of teasers, leaves Nintendo with some very tough competition indeed.

In many ways Nintendo's Project Reality claims were still uncomfortably hazy at CES. Vice president of marketing, **Peter Main**, skipped around firm technical specifications while addressing the show on the first day, and the unrealistically powerful Onyx demos did little to reassure the cynics that Nintendo could deliver such power for under $250. 'Vapourware' became the buzzword of the Nintendo stand – an Onyx packs four MIPS-designed R4400 processors, each clocking at 150 MHz, while SGI engineers claim that the Nintendo machine will only have one MIPS custom chip, with the assistance of a Silicon Graphics-designed graphics coprocessor. But given that the TV version of Project Reality will address a screen resolution roughly one quarter of the resolution used on Silicon Graphics monitors, the main question people were asking was how comparable the results will be... **Edge** can't help wondering how many people will be prepared to wait two years to find out.

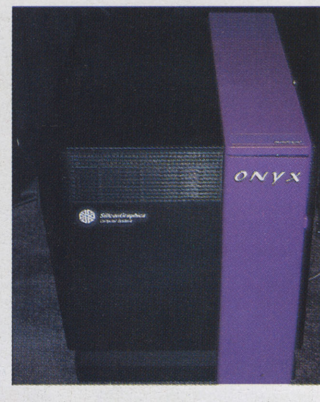
Of course, the demos were jaw-droppingly good. No-one could deny that. Few people had ever seen such complex environments being generated in real-time at 60 frames a second before. An airliner ploughed into a runway and exploded with disturbing realism, a tank was manipulated over some astonishingly realistic landscape, and incredibly detailed street scenes were zoomed around the screens like no tomorrow. However, it was a slower and more detailed demo running at 30 frames/sec that impressed the most. Taking control of a dragon flying through a beautiful canyon, the guy from SGI steadily approached a flowing waterfall and castle complete with protective guardian.

It was a breathtaking spectacle although it was still only an indication of the power of an Onyx Workstation, and not necessarily →

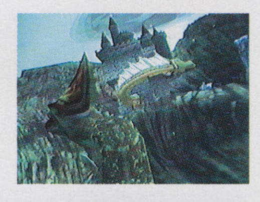
It is...

The TXE Multi System. Based on the Flair technology used in the doomed Konix machine, the TXE has twin 32bit processors running at 25MHz, a 25 Mips RISC DSP, a double speed CD drive – and will be featured in Edge 7

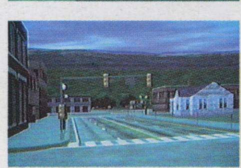




The Project Reality stand (left) wowed onlookers with its collection of demos. A $100,000 Onyx Reality² was the monster responsible (above)









Silicon Graphics demos from the NIntendo booth. (From the top) An amazing Pterodactyl flight; an airliner coming into land; an empty street scene; and lastly an articulated truck sequence



Sexier than *Sonic The Hedgehog*, that's for sure: Sega's CDX combines a Genesis and Sega CD in one tidy little package. It's being renamed the Multi-Mega over here





Nintendo's ***Stunt Race FX*** (above) and ***Super Metroid*** (right), were big enough SNES games to command their own dedicated stands

Project Reality liftoff

According to Japanese sources, three major Japanese electronics firms have agreed to supply Nintendo with the now complete MIPS-designed custom 64bit processor for inclusion in their much-vaunted Project Reality console.

Rumoured to be a hybrid of the R4000 (100 MHz) and R4400 (150 MHz), sources suggest that Sharp will follow Toshiba and NEC in signing a manufacturing agreement with the American chip designer to produce the processor.

Our source also confirmed that Project Reality will be cartridge-based, apparently relying on some breakthroughs in high density chip technology. Up to 400 megabytes of data will be available to developers per cartridge – and top Japanese developers, Square Soft, are already working on *Final Fantasy VII* for a massive 126Mb cartridge. More details as and when we receive them.

← Project Reality.

As for as Nintendo's 16bit line-up, 'competent' pretty much summed it all up. Anyone expecting follow-ups to classics like *Mario* and *Zelda* was bound to be disappointed, with these big sequels now rumoured to be held over for the 64bit system. The biggest titles Nintendo had in store were *Stunt Race FX* (previously known as *FX Trax*) and *Super Metroid* – the latter, a huge 24 meg sequel which proved especially popular with fans of the original game, even if it did lack major over-the-shoulder appeal. The same could also be said of *Stunt Race FX*, though – Sega's *Virtua Racing* easily trounced it on visual appeal, but once the control pad was nestled in the hand, it played exceptionally well.

Kirby's Tee Shot, a cute isometric golf game looked pretty if nothing else, but the lurid-coloured *Sound Fantasy* – Nintendo's mouse controlled music creation program – seemed to echo all the deficiencies and lack of credibility that *Mario Paint* suffered from. Where was *F-Zero 2*? Or *Pilotwings 2*? Will we ever get to see sequels to these classic games? Naturally, not a whisper ushered from the Nintendo stand.

Finally, 'the best play here' was Nintendo's theme for the show – an embarrassing group of choreographed dancers strutting in time to the massively annoying and repetitive 'The best play here' theme tune. Needless to say, the 'best' didn't stick around for very long.

Sega's stand offered temporary respite, though, with *Virtua Racing* proving to be a promising introduction of their Super FX-beating SVP chip, alongside *Sonic 3*. More interest, however, was given to the launch of a nifty portable Mega Drive and Mega CD called CDX. This $300 semi-portable console was swish enough to stoke some confidence back into their flagging CD platform, even if some of the CD software still looked pretty dire.

Tomcat Alley was the game that was pushed alongside the hardware – an FMV attempt at a *Top Gun*-style shoot 'em up action. But it was Zyriax's excellent thrust clone, *Sub Terranea*, that twanged the Nostalgia strings for **Edge** – a combination of contemporary shoot 'em up mayhem and traditional *Thrust* gameplay, sporting some really slick graphics.

An unexpected Genesis conversion of Capcom's *Mickey's Magical Quest*, also looked better than most Genesis titles.

Still on the Sega stand, on the first morning of the show, Sega's **Tom Kalinske** played *Virtua Racing*. Only the big attraction here was that his head-to head opponent was **Robert Kavner**, CEO of AT&T's Multimedia division, who played the game on another Genesis in a separate hall. This public union

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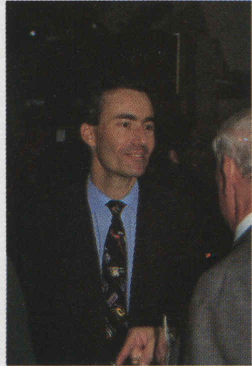






Sega President Tom Kalinske (left) playing *Virtua Racing* over the phone with the EDGE 16 modem (above). Jake, the AT&T robot (top) provided a few laughs

news







Panasonic's FZ1 digital video adaptor (above) uses the MPEG1 chipset for full-motion video

Trip Hawkins (top left) addressed the press on the first day. 3DO's impressive stand (above) included 23 licencees demonstrating their games as well Sanyo's fully working prototype system for the Japanese market (bottom left)

Continued

was only made possible with the EDGE 16 device – AT&T's $150 modem incorporating their own VoiceSpan technology, and developed by San Francisco-based PF Magic for release in the fall of this year.

Both players were shown competing on the video wall and, when quizzed afterwards, Kalinske told **Edge** that up to four simultaneous players will be able to compete in *Virtua Racing* when played over the wire. And that's not bad. In truth, other software that supported the device looked exceedingly dodgy, but with companies like EA, Spectrum Holobyte, Microprose and Crystal Dynamics working on compatible games it's a unit with serious potential. And being able to talk to your opponents as you play is certainly a big bonus.

AT&T's most entertaining exhibit, though, was easily their robotic character called Jake who was positioned up on a platform on their main stand. As show attendees paraded past, Jake would analyse them with his camera eyes, and his hidden controller would then feed him a voice and move his body accordingly. For an even greater effect, he also relied on a huge database of samples which allowed him to do perfect impressions of whoever his audience requested. That this was all wryly handled by the operator – a stand-up comic – made it all the more funny and spontaneous.

AT&T also introduced their prototype version of the 3DO at CES, a boxy grey unit with as much sex appeal as the American SNES. Two different versions of the system were promised for Autumn this year. One is a more advanced model utilising VoiceSpan hardware and an internal modem, and the other is a standard 3DO player like Panasonic's system. But if AT&T's system wins the prize for the worst designed 3DO player, surely Sanyo's unit wins the prize for being the most stylish. Their player, now in fully working form, is currently scheduled for release in Japan in the Summer.

Unsurprisingly, 3DO put up a fairly impressive show this winter – their ability to pull out the stops at CES time way outstripping their performance on the high street. Some impressive software helped them along no end, of course, with Crystal Dynamics proving their commitment once more with titles like *Total Eclipse* (Testscreen, page 58), *Orion Off Road*, a split-screen driving game, and *The Horde*, a smart-looking (and sounding) action adventure. Perhaps more interesting though, was the news that the company has already signed up to develop for Sega's Saturn, and →

Hardly the most attractive piece of kit, but at least it was there. AT&T's 3DO will include modem and VoiceSpan technology

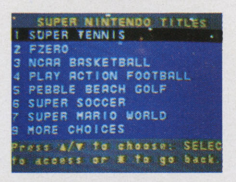
BUZZ words

rendered
it's got graphics that look better than real life, yeah that's what it means to get it all rendered... so smooth you can really see the smoothness and now i'm thinking of getting my bedroom wall rendered to make it look more like 3D and my car too so I can drive and it'll be like virtua racing only better and then i can get a rendered girlfriend with great 3D tits and...



Velvet catsuited girls, Rebellion's smart *Aliens vs Predator*, and *Cybermorph* were the only valid reasons to visit Atari's stand







Nintendo's Gateway System (top). Airline seats with LCD TV sets had a choice of SNES games. The TXE Multi System (bottom) was also unveiled at the CES

← Crystal Dynamics and the Sony PS-X seems a foregone conclusion, too.

In total 23 3DO developers got to unveil their efforts this year alongside the long-awaited and rather underwhelming versions of *Jurassic Park* and *Road Rash* which spearheaded 3DO's line-up, alongside Crystal Dynamics' games.

New companies like Naughty Dog, Tetragon and PF Magic took comfort in the corporate excesses of 3DO's huge network of monitors, while investors were relieved to see both AT&T's and Sanyo's units helping the 3DO cause just around the corner.

And MPEG has finally made it onto 3DO too, providing the essential digital video capabilities in the form of a small black box that clings gawkily to the side of Panasonic's machine. DV quality was on par with the latest results seen on Philips' CD-i, ie good in places but for the most part nothing to get VHS in a cold sweat. There were also 3DO demos of CinePak video playback and Kodak Photo CDs.

The 3DO press conference, however, wasn't quite as encouraging. Sales supremo **Trip Hawkins** seemed on edge, and his audience certainly wasn't the weak-kneed bunch of admirers that the past two CESes afforded him. 3DO's poor record since October demanded some answers and on some counts, the boy Hawkins just wasn't prepared to give them. How many units had the 3DO Company sold since launch? 'I'm afraid I can't answer that', was the unimpressive response. However, when confronted with the threat Atari posed to the 3DO dream, he offered an easy way out – 'I would suggest anyone interested in what Atari have to offer go over to their stand and see exactly what they're showing.'

One can't help wondering whether Trip would be quite so self-assured without the support of Crystal Dynamics. They were arguably the only company that had anything that might persuade you to buy a 3DO.

On **release** this month

19 **Mega Drive** games reviewed in: **MEGA**

Highest rated: **Ground Zero Texas** 84%
Lowest rated: **Ultraman** 1%

38 **PC** games reviewed in: **PC GAMER**

Highest rated: **Alone In The Dark 2** 92%
Lowest rated: **'Allo 'Allo Cartoon Fun** 38%

14 **SNES** games reviewed in:



Highest rated: **Mystical Ninja II** 90%
Lowest rated: **Mario's Time Machine** 40%

17 **Amiga** games reviewed in: **AMIGA POWER**

Highest rated: **F1** 90%
Lowest rated: **Snapperazzi** 36%

Atari's stand was conveniently out of spitting distance from both Nintendo and Sega's booths – not that either party would have had just cause to do so. Without Rebellion's *Alien vs Predator* and ATD's *Cybermorph*, the Jaguar stand would have been a wasteland of ill-conceived software. However, it was worth a trip to their stand if only to see their promotional video – an unfortunate example of the Atari marketing machine in full flow. Scratch that, full ebb.

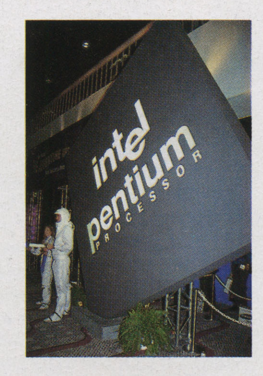
Finally, Intel won the award for the most tedious 'theme' exhibition at CES with their 'The Adventure Inside' Pentium promotion.

A guided tour through a fabrication unit recreated a clean room – a fundamental part of the chip-making process. This would have been okay if we'd been shown some evidence of the power of these 64bit workhorses. Instead, after the yawn-inducing slice of tour edutainment, visitors were bundled into a small room containing Pentium PCs and DX2s where games utilising the power of Intel's new chip were thinner on the ground than Power PCs.

All we got was a few 486 standard demos of things like *IndyCar Racing* and *Rebel Assault*. And if the huge video wall was anything to go by, a kitchen is an ideal environment for the Pentium. Especially if its hard drive is stuffed full of cooking recipes. You can see those queues forming now...

Where is it?

This place will contain state-of-the-art hardware costing hundreds of thousands of pounds. Many will represent the leading edge of 3D graphics technology, and some will allow users to enter the netherworld of Virtual Reality



The Intel Pentium Processor – it's so powerful you have to wear a protective suit to use it. Not like the PowerPC...

Developers see Sony's PS-X

Sony's new PS-X console was recently shown to developers in London. Edge has all the details...

it is...

The ATEI show at Earls Court. All the major coin-op manufacturers will be in attendance, showing off such wares as *Ridge Racer*, *Daytona Racing* and possibly even Sega's *Star Wars*. See Edge 7 for a full report

At a developers' conference in December at their headquarters in London, Sony revealed their new console – branded the PlayStation-X or PS-X – to a stunned audience.

Hamstrung by the most complex non-disclosure document they've ever seen, UK programmers and designers have at least stated that they were astonished by the power of Sony's new machine. Some typical comments were: 'It could do *Galaxian*[3] without breaking into a sweat – and without disc access,' stated one; 'It's going to revolutionise the way computers are at the moment,' said another, 'this just what I imagined the Nintendo machine to be like – it's awesome.'

The PS-X hardware is still in development – all the audience saw was a mysterious beige box the size of a PC case – but the impressive tech specs are more or less finalised. Some code has already been completed and the audience were treated to a racing sequence, plus an astonishing demonstration of the PS-X's polygon-generating capabilities. A fully rendered Tyrannosaurus Rex head – looking suspiciously similar to the one in Jurassic Park – was animated real-time via a joypad.

Sony were tight-lipped about the architecture of the machine – and even though NDAs had been signed, checked and resigned, the Sony crew still wouldn't – or couldn't – answer specific questions about the architecture and, more importantly, exact details of Sony's choice of storage medium – although Sony's press material suggests that it's CD-only.

Sony Electronic Publishing were keen to play down the event, and had no comment on the progress of the machine, only to say that **Edge** is premature in its reporting. The PS-X won't appear for at least a year, and probably longer.

The PS-X

must be a developer's dream, given that Sony are talking to the publishing community to see what they want included in the hardware, and considering the wide range of development tools Sony is providing for its licencees.

The development system is split into two sets of tools: one for artists and one for programmers. Artists' tools include a 2D sprite editor, 3D graphics editor plus a movie editor for FMV. All tools are operated via a dedicated art tablet connected to a PC. The data is then ported over to the programmer's PC which emulates the PS-X operating system (OS) in realtime and includes a C compiler and debugger. Code is then assembled and linked to a PS-X target box via a CD-ROM simulator, and a CD-ROM creator/writer allows gold (recordable) CDs to be used for debugging and testing.

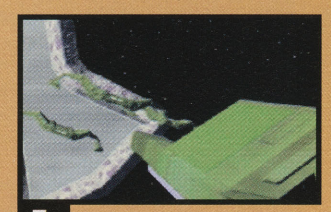
Next month, Japanese developers will →



This F1 demo is an early indication of the power of PS-X. *Ridge Racer*, here we come...

Attract mode

Once again we reach the regular spot in Edge which features the most spectacular intro sequence or attract mode of the month. This time we take a long, lingering look at the *Total Eclipse* intro (Testscreen, p58). Streaming video off CD, the 3DO treats us to some stunning computer-generated visuals, introducing us to the villains of the piece – the planet-pummelling Drak-sai...



1 Opening with a panoramic view of space, all seems well. Suddenly, from nowhere a fleet of Drak-sai appear. A huge mothership hovers into view and more Drak-sai fighters pour from its hangers. Some dramatic music begins to play



2 Cut to interior: Starbase Bravo. One of its crew members picks up a fleet of incoming fighters on his radar. He turns to notify the Commander that the fighters appear to be moving in attack formation and towards them



3 Cut to exterior scene of Starbase Bravo. As the Omega Quadrant's sun blazes away in the background, the Drak-sai zoom into view. Down go their wings, up go their shields. Suddenly Starbase Bravo seems extremely vulnerable







The PS-X's polygon-handling capabilities were aptly demonstrated by this T-Rex head. Using a standard joypad, a Sony representative was able to open and close the dinosaur's jaws – all smoothly and in real-time

← receive the 2D sprite editor, 3D graphics tools, movie data converter and a programming tool for the PC, plus a sound data converter for the Apple Mac.

Sony also intend to provide full on-line support to developers with a library of data, access to new information – and also by cultivating the exchange of information between users.

Sony's press material clearly indicates that the PS-X is targeted as a games machine, with none of the multimedia aspirations that seem to have backfired on 3DO and CD-i. There's also an emphasis on 'real-time' in generating 3D or video images and player response, with feedback down to at least within 2/60 of a second.

Initial targets are for three million unit sales in the first year, generated by its advanced technology, aggressive 'consumer-attractive' pricing, an extensive library of titles and, of course, the Sony brand name.

As exclusively revealed in **Edge** five, the PS-X is based around the 32bit R3000A RISC chip running at 33MHz and 30Mips with a huge bus bandwidth of 132Mb/sec. It has a main RAM of 8Mb, with 8Mb of VRAM, 4MB of sound RAM, a 256K CD-ROM buffer and an operating system that takes up a vast 4Mb of ROM.

The PS-X has a dedicated data decompression engine, which runs at 80Mips, and is compatible with JPEG, MPEG1 and H.261 files. It's not yet known whether the PS-X will have MPEG built-in, enabling it to play Digital Videos and FMV titles, in the same way as CD-i and CD^{32}.

As with 3DO's custom hardware, the PS-X can scale, rotate, distort and warp sprites, and is able to display up to 4,000 8x8 sprites every 1/60 second. If the RISC chip is the heart of the machine, the brains is the GTE geometry engine, which is a high speed matrix operating processor, rated at 66Mips. Capable of rendering 1.5 million flat shaded polygons per second, or half a million Gouraud shaded, texture-mapped and light-source shaded polygons per second, Sony's technology puts the PS-X 'way out there', as Trip Hawkins would say.

It looks like Sony have got it completely right: the 'quantum leap' that 3DO wanted to take looks like a tentative step compared to the sheer power of PS-X. 'Nothing can touch it' seems to be a popular phrase, and given that Sony are intent on launching with a large library of good quality titles, everyone else had better watch out when they do...



Sony's assault on the games market began in earnest in 1991 when it formed Sony Electronic Publishing.

Set up to produce and distribute interactive media, it now has five operating divisions

Sony Imagesoft – Sony's videogame label which supports all Sega and Nintendo platforms. Its first games appeared in early 1993.

Psygnosis – Which Sony bought out in 1993, and which produces games on all formats, but is now concentrating on CD.

Multimedia Productions – Sony's CD-ROM division which licences, develops and distributes PC and Macintosh CD titles.

Publishers Data Service Corporation – Which offers a technology support service to software publishers.

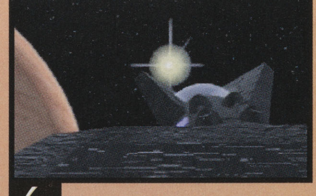
Recorded Media – Provides sales, marketing and technical support for Sony's CD-ROM and LaserDisc divisions.



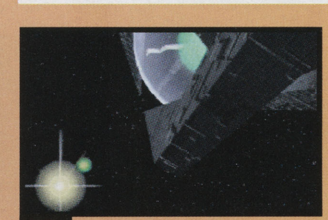
4 **Cut to close up of the Commander. Cool, calm and collected, seemingly oblivious to the chaos going on around him, he asks one of his crew members to put up the video screen. It's time to talk to the Drak-sai leader...**



5 **The evil leader – Lord Zodak – materialises on the video screen. Hissing like a snake, Zodak explains that the crew of the Starbase Bravo should be honoured, as the 'Drak-sai only feed on intelligent and ssskillful ssstar fightersss'**



6 **Cut to exterior. Zodak warns the Commander not to resist. And, so as to emphasise the point, out comes the Drak-sai's main weapon – the Sun Dagger. Aimed directly at Omega Quadrant's sun, Zodak gives the order to open fire**

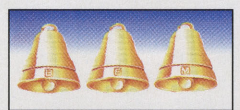


7 **The Sun Dagger lets loose with one single bolt. The Commander can only sit and watch as the sun explodes. Darkness fills the screen, the music dies down and the sound of Lord Zodak's laughter fades away. Game on...**

Zool: first PC game to hit arcades

Developers ATD and coin-op experts Bell Fruit have produced a new system that allows easy conversion of PC games to arcade format. *Zool* is their first subject. Edge reports



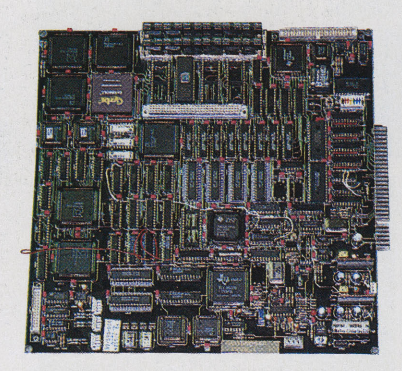


Gremlin's *Zool* is about to become an arcade hero thanks to a new coin-op system jointly developed by Attention To Detail, and Bell Fruit Manufacturing who provided the funding for the first machine.

ATD – who helped debug the Jaguar chipset and developed *Cybermorph* for Atari – have invented a dual hardware/software system based around an Intel 486-type processor. So, as well as running a 256-colour *Zool*, their system can easily have PC compatible software ported to it.

Bell Fruit Manufacturing – who will be using the new hardware in their *Zool* cabinet – are hoping to harness the games community in the UK to write programs for the system. They are already talking to several companies who are all keen to get their PC games in the arcade – without having to shell out on dedicated hardware.

Martin Green, R&D director of ATD and inventor of the system explains: 'The kind of thing you'll see is conversions of products already in the market, or new products written by PC games companies. The UK games development community is very well represented on consoles, but have a low profile in the arcades – this may help to change the situation.'



ATD's prototype 486-compatible coin-op board. The finished article will eventually be at least half the size

'Of course, when you say arcade, the ones people talk about are the ones at the top – the *Virtua Racers*, *Galaxian³s*, *Ridge Racers* – those machines are all well over £10,000 apiece. Our system is much cheaper and very scalable.'

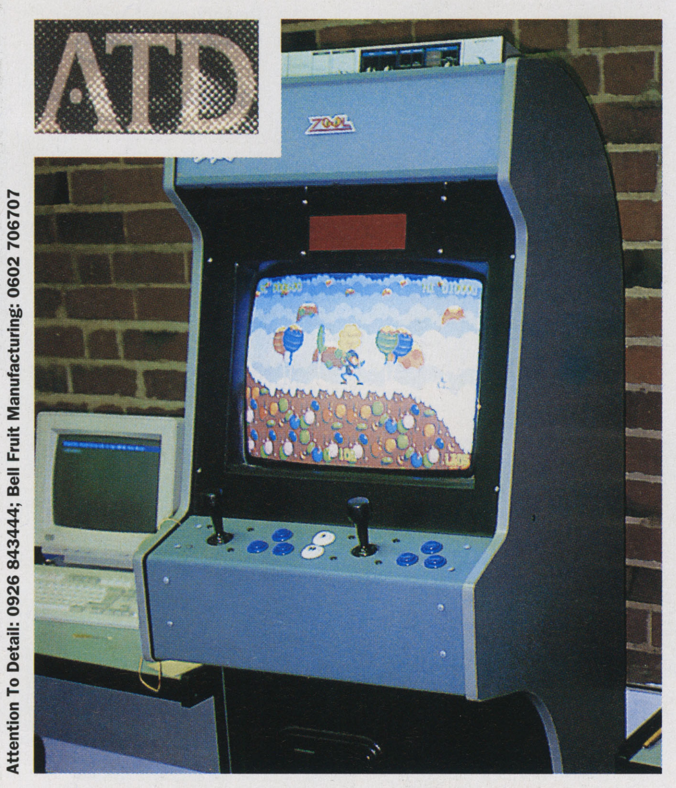
The clever part of the new system is that it only uses a small custom hardware component – around 5,000 gates – and most of the work is done in software. 486-type processing is used because it's relatively cheap and eases the process of portability.

However Martin points out that 'There is a massive range of 486-compatible processors on offer which give us a lot flexibility. For an extra £150 onboard cost, we can use a DX2/66 and double the performance. We've also got our eye on some of the new RISC chips, like the DEC Alpha – 20 times current performance for only £300!'

ATD see bus bandwidth (the amount of data the architecture can handle) as the main problem with much existing hardware. As Martin says, 'A wide databus is like having a great big truck: it's great for hauling tons of stuff around, but if you want to take something down the road it's useless.'

The new system eliminates this by →

ATD



The completed *Zool* running in a standard cabinet. Bell Fruit will produce dedicated units for distribution in pubs and arcades

Attention To Detail: 0926 843444; Bell Fruit Manufacturing: 0602 706707

Data stream

Biggest selling 16bit console game of 1993: **Mortal Kombat**
Total amount spent on marketing *Mortal Kombat* in the UK: **£2.2 million**
Number of football games either released or due for release between December 1st and July 1st: **11**
Number of football teams from Britain participating in the World Cup: **0**
Number of computer and videogame magazines currently clogging up the shelves of all good (and most bad) newsagents: **59**
Title voted Magazine of the Year by the great and the good of the games industry: **Edge**
Number of consoles in use in the UK as of 1st January 1994: **9.4 million**
Number of exhibitors at this month's US Consumer Electronics Show (CES) in Las Vegas: **79,000**
Total floor space covered by CES exhibitors: **1,006,280 square feet**
Floor space at CES covered by interactive entertainment industry: **171,902 square feet**
Floor space covered by Nintendo display: **59,427 square feet**
Floor space at the CES covered by Sega display: **37,697 square feet**
Money invested by Atari founder Nolan Bushnell on the formation of the company in 1972: **$250**
Sum paid to Bushnell by Warner Bros when buying Atari in 1977: **$28 million**
Amount of money lost by Atari for the year ending December 1st 1992: **$73.6 million**
In Japanese, the word Nintendo means: **'Work hard, but in the end it is in God's hands'**
Expected total CD³² sales by Jan: **75,000**



R&D director Martin Green (left), and managing director Chris Gibb (right) of Attention To Detail. Their new hardware/software system could revolutionise low-end coin-ops

When is...

The 12" LaserDisc format has been around for more than ten years. However, this is the first time that the possibility of playing back video footage from Philips' new Compact Disc format was fully realised...









The *Zool* coin-op boasts an animated intro and new level designs by Gremlin, while ATD recoded the game, adding parallax scrolling in 256 colours

keeping all processing on-chip. Electronics on-chip are three to 10 times faster than off-chip, and it also reduces the need for lots of external RAM.

'What we have is something that eliminates bus bandwidth as the main way of rendering graphics.' says Martin. 'Traditionally, most games start off by having an empty screen buffer and you paint objects from the back, forwards towards the screen until you've got the image you want. What we have is a method that uses on-chip processing to do the same thing. The actual truth is that there's no screen memory at all.'

According to Martin: 'If you look at the underlying hardware, a programmer would be hard pushed to get a single sprite moving: it doesn't work that way. There's a whole layer of highly optimised software that implements our algorithms and actually does the work.'

ATD are quick to point out that this makes the system very easy to work with: programmers won't have to get to grips with learning the vagaries of new chipsets or operating systems.

The ease of use, portability and scaleability of the system makes it a target for many new developments. Martin explains: 'We have the first machine up and running *Zool*, and we'll continue to develop increased performance arcade systems, but we're also looking to take the architecture into any other market that it's suitable for. One of the most interesting ideas is to implement a very low-cost version completely in hardware, which would open up all sorts of opportunities in consumer electronics. That might be low-end consoles, high-end arcades or windowing systems on graphic interfaces.

'Obviously we don't want to give too much away,' says Joint MD **Chris Gibb**, 'but we have a technology, and we're looking for applications for that technology in other markets. It has specific advantages which are: ease of development; scalable performance; and a low bus bandwidth requirement.

'In particular we can see strong advantages in low-cost Virtual Reality, hand-held consoles and interactive TV.'

And you can expect to see the first fruits of this new technology in the arcades later this year...

i wish...

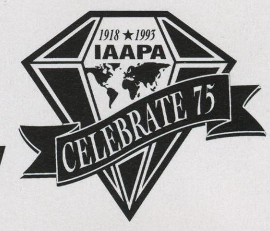


Eric Matthews

'... That an internationally successful, mass market, single machine format emerges that is appropriate to a variety of game styles, with an open publishing approach. I know this is every developer's wish and I also know that it's not going to happen, so here are some more wishes...
2. I wish there would be a ban on the supposed Quality Control approval system adopted by certain manufacturers, which only goes to create safe, formula entertainment and kills creativity and innovation.
3. I wish that hardware manufacturers would communicate with software developers in the form of information (and obviously cash).
4. I wish that Commodore succeed (you did ask for wishes).
5. I wish there was a button that you could stick on the front of any PC to enable it to automatically detect and configure itself for every game, application and card you install. If this doesn't happen then PCs are out of the running for wish number one.
6. I wish there could be a ban on licensed games, apart from those done at LucasArts – who will be allowed to continue because they know what they are doing.
7. I wish I could be given a free copy of *Sam And Max* on CD-ROM. If this wish doesn't come true, LucasArts are banned as well...'

Eric Matthews is director of The Bitmap Brothers – the creators of *Speedball*, *Gods*, *Xenon* & *Xenon II*.

VR raises profile at IAAPA show



The latest Virtual Reality kit was on commercial display for the first time at this year's IAAPA. Edge was there

it is...

Five years ago. The very first FMV was squeezed onto a CD by RCA's research team in Princeton. A second of video took *minutes* to decode – happily, things have improved since then (see p54)



The IAPPA event was a hotbed of activity for all sorts of amusement attractions – but VR stole the show

The American International Association of Amusement Parks and Attractions (IAAPA) annual exhibition was held for the first time in Los Angeles this year, and it featured a record 822 exhibitors covering a massive 300,000 sq feet. This incredible gathering of the hottest attractions managed to pull in 25,000 visitors from around the world.

And it's easy to see why: Virtual Reality (VR) entertainment for theme parks and special Location Based Entertainment (LBE) centres was on commercial display for the first time at the show.

Three main concept systems competed at IAAPA. The first was the Head Mounted Display (HMD) system produced by Visions Of Reality Corp. This system uses the latest compact HMDs (Head Mounted Displays) to provide immersive VR, linked up in a six pod configuration.

There is only one game completed for the machine so far, called *CyberGate*. *CyberGate* will be ready for installation in the first quarter of this year, and will cost LBE centres a cool $500,000, with current estimations of the playing costs at around $8 per ride. The whole thing is powered by a Silicon Graphics Onyx Reality Engine, and uses Kaiser Electro-Optics display units.

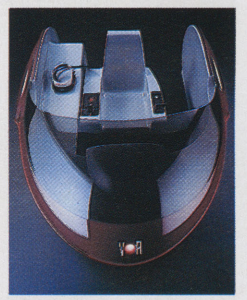
Before entering into combat, each player chooses their allegiance – either to the Shandari race or to the Ptox. Pilots each receive a player's guide and an intergalactic passport on which to keep a log of their missions and kills.



The next system gathering interest was the Virtual Adventures machine, created jointly by Iwerks Entertainment and military and commercial image generator Evans & Sutherland. The system uses computer generated scenery and special 3D glasses to create a fully immersive environment.

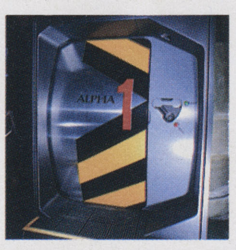
It gives six players sitting in a submarine mock-up the virtual experience of traversing the bottom of Loch Ness in search of the monster and her eggs. Each player assumes a different role, with positions for pilot, navigator, two observers and two crew members operating the robot arms. →

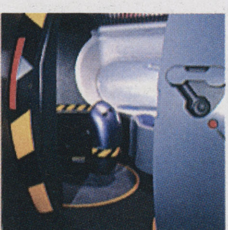






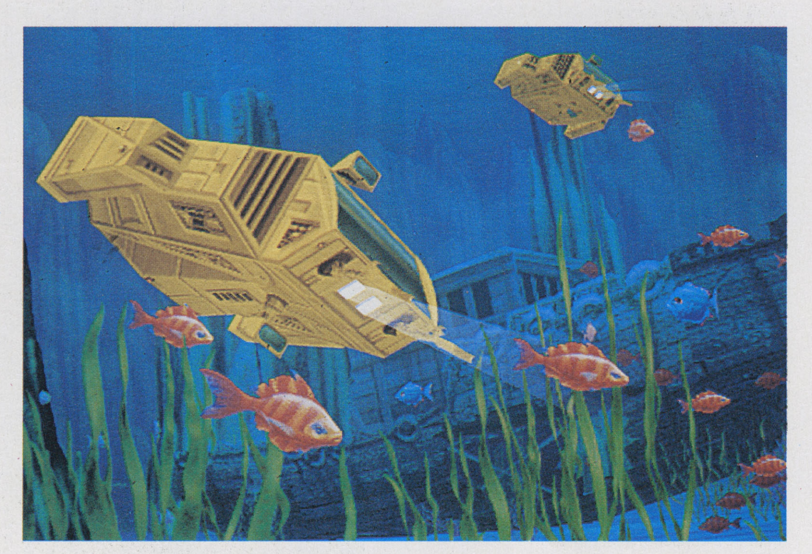
VOR's *Cybergate* gives you the chance to help the Shandari in their war against the Ptox – or vice versa. The player's guide (top) gives you some history of the conflict, while the pod (middle) houses the hardware needed to generate the deep space battle scenes (bottom). VOR are looking to site a *Cybergate* system in London very soon







Entering E&S/Iwerks' Virtual Adventures ride (from top to bottom). The periscope screen provides a view of your computer generated surroundings; 3D glasses give it depth



Take a trip through the suspiciously un-murky depths of Loch Ness with the Evans & Sutherland/Iwerks' Virtual Adventures ride. A full set-up can be yours for just $1.8m

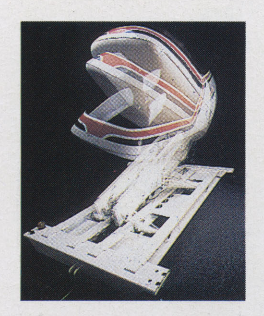
← Four submarine capsules compete in the search, while another four are being prepped ready for the next ride. Different roles are given to each team for each game, either acting as archeologists attempting to save the eggs, or as a band of bounty hunters out to make a quick buck!

The engine behind the ride is the mighty ESIG 2000 – and would-be purchasers of Virtual Adventures can expect to pay a vast $1.8 million for the hardware. The actual system on display at the show was only 80% completed, but it still looked like it will be well worth the $5 you'll pay for a ride when it actually surfaces mid '94.

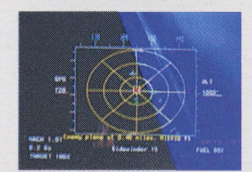
The most popular stand of the whole show was Magic Edge's Hornet-1 simulator – another system running SGI's Onyx engine. This one seater motion capsule has full G-loading, giving the player a taste of the forces pilots endure on launch or during the twists and turns of evasive manoeuvres. This is thanks to the custom motion platform that the system rests on – capable of a stomach-evacuating 360° of roll and 70° of sideways pitch.

Once the player gets inside the machine (having first completed all digestive processes), he has to put on a specially fitted seat harness and a headphone set that keeps him in contact with the flight commander and other jets within the game environment. The player can then take off and fly round the virtual world destroying specially selected targets, including planes, installations and ships.

The sleek lines of the Hornet-1 capsule and its super-fast graphics drew the crowds – but the trade were equally impressed by the fact that the system is fully backed by Namco and Silicon Graphics. And plans are afoot to open special LBE centres dedicated to these capsules within specially created cyber-warzones. Expect more on this soon.







Magic Edge's Hornet-1 (top) – a real stomach churner of a ride. Running on a Silicon Graphics Onyx engine, the futuristic air combat scenes (middle, bottom) are mightily impressive

IAAPA did more than just preach to those already converted to the VR faith, though. Members of the film industry, (just down the road in Hollywood remember), were at the show in force to try out the best VR kit around. After all, there's a general feeling in Hollywood that VR could be the next step in mass audience entertainment, and naturally the movie moguls don't want to get left behind if and when VR takes off. After all, *very* big bucks could be at stake here.

IAAPA was a spectacular explosion of new ideas for location-based visual and interactive entertainment: but more importantly it was also the place where the US entertainment industry got its first real taste of high-end VR systems outside of professional simulation environments.

And all this means that the next generation of VR entertainment centres could be happening sooner than we thought. Watch this space...

Datebook

February

Virtual Reality '94: Novotel, Hammersmith, London (071) 976 0405. Feb 1st-Feb 2nd, Open from 9.30-5.00. Tickets £10 on the door. Trade free. This event could well be *the* place to be in February.
AOU Show: February 22nd-23rd. Japan Convention Centre, Makuhari Messe, 2-Makabe Chiba-shi, Chiba, Tokyo. Call: 010 81 (3) 866 9371. Japan's BIG coin-op show: expect 3D games to be the talking point.
Blackpool Amusements Exhibition: The Wintergardens, Blackpool. February 22-24th. Call: North West Exhibitions on 0235 25252. The North's equivalent of the ATEI.

March

ACME Show: March 17th-19th. O'Hare Exposition Center, Chicago, US. For more details call the organisers on: 0101 (708) 333 9292. Huge US coin-op show.
Taiwan Amusement Exhibition: Held at The World Trade Centre, Taichung, Taiwan. Contact Creative International Public Relations Consultants, 9th Floor, 21 Chung Ching S Road, Section 3, Taipei, Taiwan, Republic Of China. Tel: 010 886 (2) 393 7404.

April

International Computer Show: Friday 22nd April-Sunday 24th, Wembley Exhibition Hall (0222) 512128, Open 10.00-6.00 Fri-Sat, 10.00-4.00 Sun. Tickets £7 adults, children under 10 £5. Advance ticket discount. Good place to pick up bargains on all things computer-related.
European Computer Trade Show: April 10th-12th. Open from 9.30am to 5.30pm at the Islington Design Centre, London. For further details call: (081) 742 2828. Main event for showing off the latest videogame wares – and general industry watering hole.
MIDI & Electronic Music Show: April 22nd-24th. Wembley Conference Centre. Open 11.00-6.00 Fri, 10.00-6.00 Sat, 10.00-4.00 Sun. Tickets £8 on the door, £5 in advance. For further details call: 0222 512128. Your chance to see – and buy – all the latest in the world of electronic music.

June

Consumer Electronics Show, Chicago: June 23rd-25th. Organised by Consumer Electronics Group of Electronics Industries Association. (0101 202 457 8700). Huge videogame event – like the Winter CES, but windier.

Show organisers: if your show isn't listed here, it's only because you haven't told **Edge** about it. Do so on 0225 442244, or fax us on 0225 338236, or send details to **Datebook, Edge, 30 Monmouth Street, Bath, Avon BA1 2BW**



Charts

The very latest **charts** from across the entire world of videogaming

Amiga

1 **Cannon Fodder**
***Virgin* (£30)**
2 Frontier: Elite II
Gametek (£30)
3 Mortal Kombat
Virgin (£30)
4 Premier Manager 2
Gremlin (£26)
5 Zool 2
Gremlin (£26)
6 Championship Manager 94
Data Disk *Domark* (£10)
7 Monkey Island *Kizz* (£17)
8 Micro Machines
Code Masters (£26)
9 The Settlers *Blue Byte* (£35)
10 Sensible Soccer 92/93
Renegade/Mindscape (£26)



Lots of movement in the Amiga chart this month. From nowhere, *Cannon Fodder* (above) storms straight into the number one spot. *Mortal Kombat* makes its presence felt at number three, while *Micro Machines* screeches into number eight. *Zool 2* also makes its debut, straight in at number five



Many thought that the characters from *Street Fighter* would be strong enough to hold onto the number one spot for many months, but their appeal seems to have been limited. *FIFA International Soccer* (above), *Aladdin* and *Sonic Spinball* all surpass the mighty Capcom game. Sensible Soccer's sudden emergence at number eight knocks the very poor *Jurassic Park* out of the top ten. Expect to see the soon to be released *Virtua Racing* battling for total Mega Drive supremacy

Mega Drive

1 **FIFA International Soccer**
***Electronic Arts* (£45)**
2 Aladdin *Sega* (£50)
3 Sonic Spinball *Sega* (£45)
4 Street Fighter II Champion
Edition *Capcom* (£60)
5 Mortal Kombat
Arena Entertainmet (£50)
6 Jungle Strike *EA* (£45)
7 F1 *Domark* (£50)
8 Sensible Soccer
Renegade/Sony (£40)
9 Sonic 2 *Sega* (£40)
10 Micro Machines *Code Masters*
(£35)

Super NES

1 **Mario All Stars**
***Nintendo* (£50)**
2 Street Fighter II Turbo
Capcom (£60)
3 Nigel Mansell's World
Championship *Nintendo* (£40)
4 Aladdin *Capcom* (£45)
5 Jurassic Park *Ocean* (£55)
6 Mortal Kombat
Acclaim (£60)
7 Super Bomberman
HudsonSoft (£45)
8 Striker
Elite (£45)
9 Super Mario Kart *Nintendo*
(£40)
10 Cool Spot *Virgin* (£45)



Nintendo's icon, Mario (above), together with his All Stars, still rules the lives and pockets of many Super Nintendo owners. Rik Mayall has obviously helped the sale of *Nigel Mansell's World Championship* over Christmas, and it moves straight into number three. The only other new entry is Ocean's *Jurassic Park*

PC CD-ROM

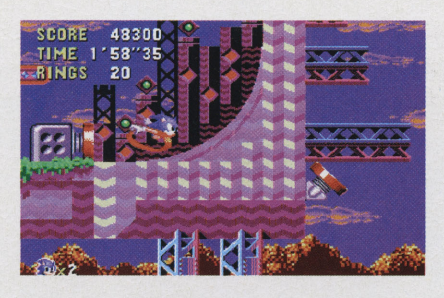
1. **Rebel Assault** ***US Gold* (£46)**
2. Day Of The Tentacle *US Gold* (£46)
3. Dracula Unleashed *Mindscape* (£50)
4. The 7th Guest *Virgin* (£70)
5. Return To Zork *Activision* (£50)
6. Lord Of The Rings *Interplay* (£45)
7. Dune *Virgin* (£50)
8. The Journeyman Project *Gametek* (40)
9. Indiana Jones: Fate Of Atlantis *US Gold* (£46)
10. Battle Chess *Interplay* (£45)



As we expected, *Rebel Assault* (above) goes straight to the top of the tree. It's amazing to think that Virgin's *The 7th Guest* hasn't fallen out of the top five since Edge was conceived. *Journeyman Project* and *Indiana Jones* are the only other new entries this month, reaching numbers eight and nine respectively

PC

1. **Frontier: Elite II** ***Gametek* (£40)**
2. Network Q RAC Rally *Europress* (£35)
3. Monkey Island *Kixx* (£17)
4. Microsoft Flight Simulator *Microsoft* (£40)
5. IndyCar Racing *Virgin* (£45)
6. TFX *Ocean* (£45)
7. Jurassic Park *Ocean* (£35)
8. B-Wing *US Gold* (£21)
9. Lemmings 2 *Psygnosis* (£40)
10. Xmas Lemmings *Psygnosis* (£15)



After months of non-activity, Mega CD owners finally have new titles. Doing what he does best, *Sonic* (above) claims the number one spot. The excellent *Thunderhawk* from Core Design also makes a dramatic entry. *Lethal Enforcers* at number three, and *Silpheed* at number six are the other newcomers

Mega CD

1. **Sonic CD** ***Sega* (£45)**
2. Thunderhawk *Core* (£45)
3. Lethal Enforcers *Konami* (£55)
4. Night Trap *Sony* (£50)
5. Sewer Shark *Sony* (£45)
6. Silpheed *Game Arts* (£50)
7. Final Fight *Capcom* (£45)
8. Ecco *Sega* (£45)
9. Batman Returns *Konami* (£50)
10. Sherlock Holmes *Sega* (£50)

Most wanted

1. **Star Trek: The Next Generation: 3DO**
2. Alien vs Predator: Jaguar
3. Jurassic Park: 3DO
4. Tie Fighter: PC
5. Rise Of The Robots: CD^{32}



Another 3DO game claimed the most votes in this month's most wanted chart. *Star Trek: The Next Generation* (above), just managed to pip *Alien vs Predator* on Atari's Jaguar. Remember, you can send your own most wanted lists to Edge, 30 Monmouth Street, Bath BA1 2BW

SFC (Japan)

1. **Dragon Ball Z2 *Bandai* ¥9800**
2. Dragon Quest I.II *Enix* ¥9600
3. Romancing Saga 2 *Square Soft* ¥9900
4. Super Puyo Puyo *Banpresto* ¥8200
5. Legend of Haou *Koei* ¥12800
6. Fatal Fury 2 *Takara* ¥9980
7. Aladdin *Capcom* ¥9000
8. Gia's Illusion *Enix* ¥9800
9. Super Mario Collection *Nintendo* ¥9800
10. Tournament Fighters *Konami* ¥9800



The success of the *Dragon Ball* series can't be ignored in Japan – it's been one of Bandai's biggest licensing opportunities, and shifted large numbers of their one-one-one beat 'em up – with the new sequel set to do the same. Takara's Neo-Geo beat 'em up conversion, *Fatal Fury II*, (above) stands at number 6 this month. Import buyers might want to look out for certain games, in particular *Super Puyo Puyo* – a conversion of Compile's splendid Mega Drive *Columns* clone, and Enix's *Soul Blazer*-style action RPG, *Gia's Illusion*

MD (Japan)

1. **Fantasy Star IV** ***Sega* ¥8800**
2. Shining Force II *Sega* ¥8800
3. Dream House (CD) *Sega* ¥7800
4. Puyo Puyo *Sega* ¥4800
5. Sonic CD *Sega* ¥8800
6. Columns III *Sega* ¥6800
7. Lethal Enforcers (CD) *Konami* ¥9800
8. Street Fighter II Dash *Capcom* ¥9800
9. Aldark (CD) *Sega* ¥8800
10. Aladdin *Sega* ¥8800

Twisted Ridge Racer **Stunt Race FX** Star Trek: The Next Generation **Way Of The Warrior** John Madden Football **Doom: Evil Unleashed** Virtua Racing **Zeewolf**

Prescreen

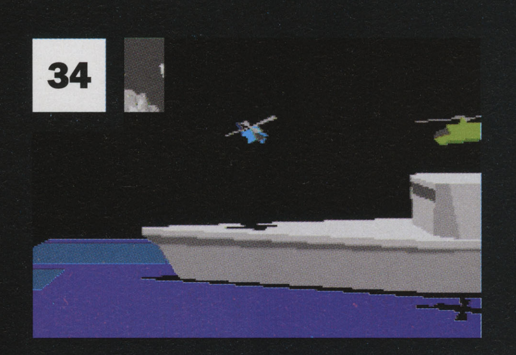
3D graphics certainly seem to be the theme of this month's Prescreen section, with some truly amazing forays into the third dimension.

Top of the list is *Ridge Racer* – a stunning coin-op with images that belie its videogame heritage. More of a driving simulator, it is a visual extravaganza, with graphics to make *Virtua Racing* squirm with inferiority. **Edge** has exclusive screenshots from Namco with details of the power behind the pictures.

Also taking centre stage has to be *Doom* on the PC – the most atmospheric and physically frightening game **Edge** has ever seen. Id Software have honed their 3D graphics engine to pefection, allowing you to roam anywhere within the game world, and it's all portrayed with worrying realism.

And we also have *Zeewolf* from Binary Asylum. A game which has the audacity to contain *real* playability. The upstart...

34



32



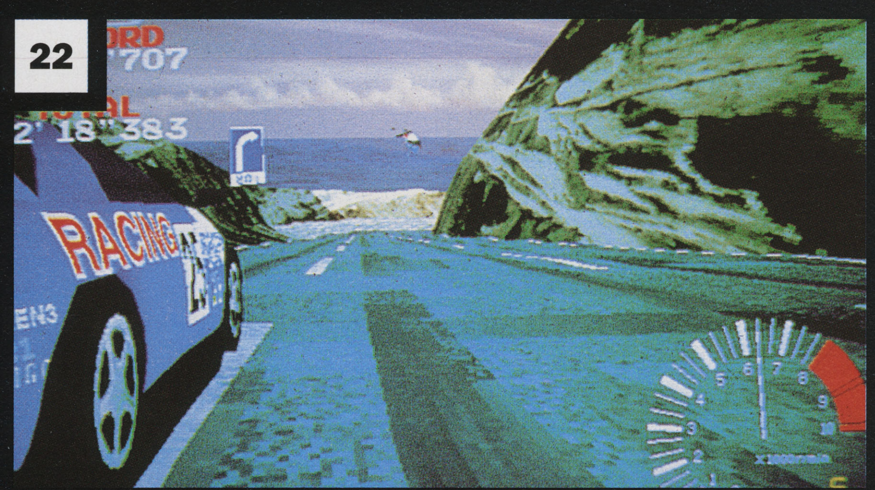
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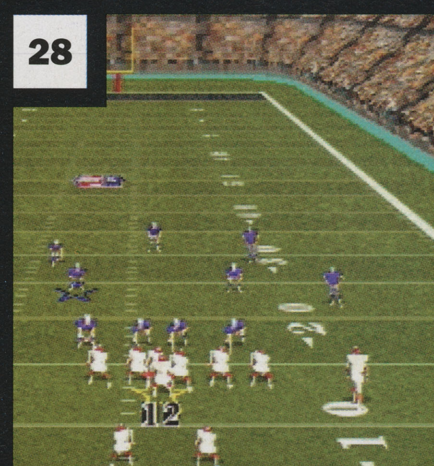
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22



28







Your host, the overly excited Dwink Disdale, introduces all the show's characters (top and middle). Up to six people can join in...

Twisted

The first surrealistic game show gets set for its premiere on the 3DO. Edge takes an early look...

Format: **3DO**
Publisher: **Electronic Arts**
Developer: **In-house**
Release date: **03/94**
Size: **1 CD**
Origin: **US**

It's a bit difficult to explain exactly what *Twisted* is all about, but if you can imagine taking part in a surrealistic and zany American game show, then you're halfway to understanding it.

You and five friends take part in the 'show' and your object is to reach the top of a spiralling staircase – simple, eh? Each player takes turns in stopping a random number selector, and that number is then turned into a series of moves up the staircase – provided you can complete a challenge.

Now this is where things start to get a little crazy – as most of the challenges themselves are incredibly weird. One requires you to watch some film footage of a shopping trolley being pushed around a supermarket at speed. You then have to pick out certain items that didn't appear on the shelves. Another challenge is a play on the old 'match the picture' game. Only this time, you don't match the picture, you match the strange sound, and the things that make the strange sounds are, wait for it, ex-US presidents.



This may look like a simple puzzle, but there are so many possibilities and only one correct solution – all done against the clock, of course

The creators of *Twisted* at Electronic Arts have taken the rulebook and quite literally ripped it to shreds. In doing so, they've presented game reviewers with all sorts of problems; just how do you review a videogame game show?

Find out in a future issue of **Edge**, as *Twisted* is nearly complete and is due out in March.

The creators of *Twisted* have taken the rulebook and quite literally ripped it to shreds



Humble Howard is looking to increase his position up the staircase (above) after 'throwing' a six. This board (left) is used to decide which challenge he'll do

Ridge Racer

Format: **Coin-op**
Publisher: **Namco**
Developer: **In-house**
Release date: **Spring '94**
Origin: **Japan**

Namco's new racing coin-op takes the art of 3D visuals to new heights. And **Edge** has the pictures to prove it



Namco's commitment to realism even extends to the time of day. Here, you're driving towards the coast in the late afternoon...



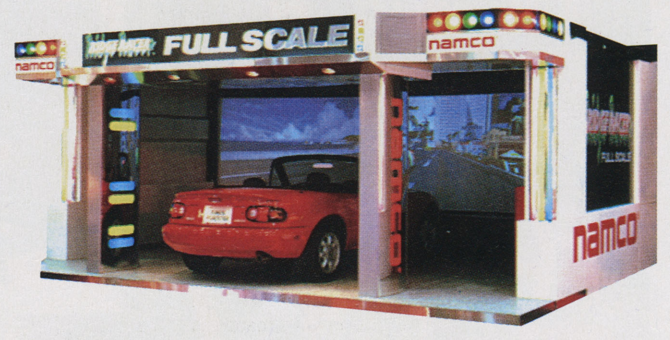
... then later on the sun begins to set, issuing in a starry evening sky

From the early days of *Pac-Man* (plus numerous sequels thereof) and *Dig Dug*, Namco have been a major power in the coin-op field. Titles like *Galaxians*, *Rolling Thunder*, *WEC Le Mans* and *Splatterhouse* have built up its name; machines like *Galaxian³* and *Air Combat* have allowed Namco to hone their technology; and *Ridge Racer* has taken that technology to new heights.

This amazing driving simulator (the term 'coin-op' doesn't really do it justice), has just appeared in Japan. The game is based on Namco's new 3D-CG board, System 22. At the heart of System 22 is a 32bit CPU running Namco's own high performance graphics engine, TR3 – which stands for the Texture mapping, Real time, Real visual Rendering system.

System 22 boasts super high speed calculation and drawing functions, supporting full texture mapping, Gouraud shading and depth cueing for *every* polygon onscreen. System 22 can also handle up to eight separate image windows – a function neglected on *Ridge Racer* but one which could be used for multiple viewpoints, exterior shots, remote cameras, and so on.

Ridge Racer is a full spec driving simulator with positive feedback steering wheel, six-speed manual gear change, accelerator, brake and clutch pedals. So far it comes in two models: a typical sit-down cabinet, and the formidable Full-Scale system, which incorporates a Mazda MX-5 convertible (known as the Eunos Roadster in Japan), and curved 20ft



The ultimate driving game: *Ridge Racer* Full-Scale. Tire of the simulation and you still have a Mazda MX-5 to go for a real spin



Blasting into the night, you're hot on the tail of this yellow sportscar. You could be forgiven for thinking this was a real photograph...



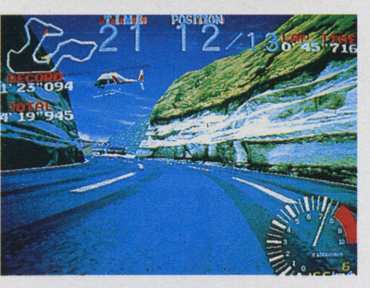
... Even up close, the detail on the car is glorious: check out the tail lights!



Even deserted roads look great. *Virtua Racing*? Eat your heart out, Sega







The level of detail in *Ridge Racer*'s texture mapping is astonishing: cars, buildings, cliffs – even helicopters are rendered with alarming realism. And if the specs are to be believed, Sony's PS-X version should be just as good

by 5ft screen for the ultimate in rubber-on-road action.

The game has four different play modes: rookie, intermediate, advanced and time trial. Depending which mode is selected you get one of two courses: one for rookie and intermediate, and a more difficult course for the advanced play and time trial.

Using the same structure as most racing games, you gain extra time by passing checkpoints. As you speed around the course (maximum simulated speed varies up to 230 km/h in the time trial) you progress from a cityscape, through winding mountain roads, and finally arriving at the coast. As the race moves on, the sun sets and you eventually end up racing against a starry night sky.

Certainly the visuals are far superior to those in *Virtua Racing* – although Sega's up-and-coming *Daytona Racing* might give it a run for its money.

Ridge Racer had its European unveiling at the ATEI show in January (full report next issue) and should be hitting UK arcades over the next month or so. Start saving...

As the race moves on, the sun sets and you eventually end up racing against a starry night sky

Stunt Race FX

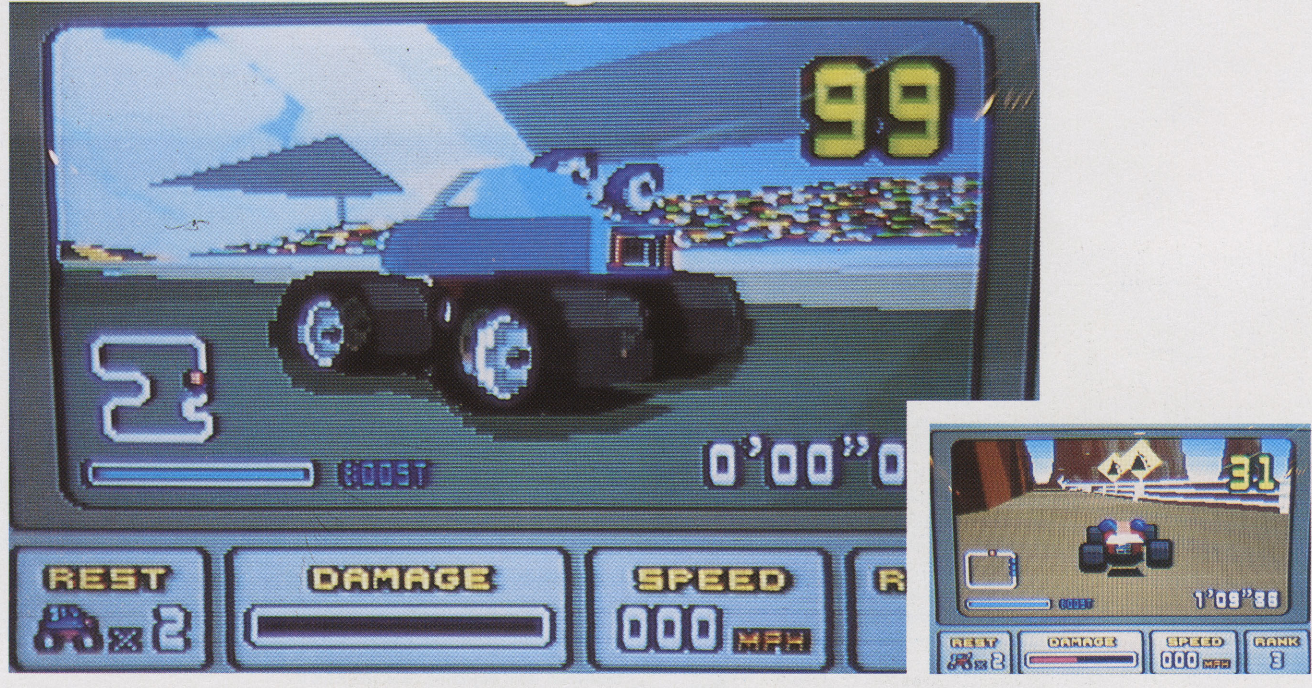
The first game to use Nintendo's improved Mario chip looks set to be a winner. **Edge** reports...

Format: **SNES**
Publisher: **Nintendo**
Developer: **In-house**
Release: **February (Jap)**
March (US)
Size: **8Mbits**
Origin: **Japan**

Stunt Race FX (originally titled *FX Trax* for the Japanese market) made its second public appearance at the recent CES in Las Vegas, the first being at last year's summer CES. And, unlike the version shown at last year's show, this nearly completed version was smooth, fast and contained lots of texture-mapped roadside objects.

First impressions are that *Stunt Race FX* looks more like a polygonised version of that old arcade classic *Buggy Boy*. But developers Argonaut Software, in conjunction with the talented and creative genius of Shigeru Miyamoto – the man behind *Mario*, *Zelda* and *StarWing* – have given *Stunt Race FX* a very distinctive look and feel.

Described as a 'fantasy racing game', the visual effects in *Stunt Race FX* are very impressive: undulating hills, huge scaling roadside objects, your car even has independent working suspension. There are also a great



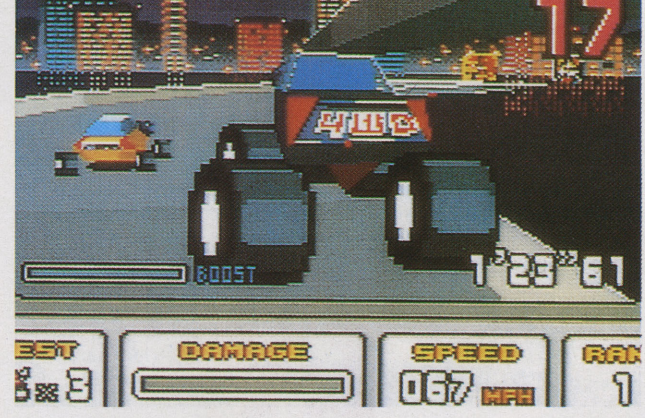
Although not as silky smooth as one might have hoped for, *Stunt Race FX* is still a bit of a looker. This huge vehicle (above) is only one of the three cars you can choose. Driving along a mountain path (inset) can be treacherous at the best of times. Watch out for falling rocks...



Just for the show, a ***Stunt Race FX*** **sit-in buggy**



One of the man-made dirt tracks – collect those flags for bonus points



Two views can be selected, one near and one not so near – guess which one this is? A bridge that you'll be going up in a minute looms ahead

collection of tracks to race on, and a variety of different modes to play.

Stunt mode takes place inside a stadium where large gaps have to be jumped and flags have to be collected. One of the other modes, Speed mode, is set over a more conventional race track, and some of its stages require you to race cross-country style over mountains and through tunnels.

A split screen twoplayer mode is also featured, but the screen has had to be shrunk in order to accommodate all the information for both players.

Stunt Race FX is the first game to house the new and improved Mario chip – the correct name for the Super FX chip. And running approximately 30% faster, the next generation chip looks certain to transform what could so easily have been an average racing game into a visually stunning and very playable one.

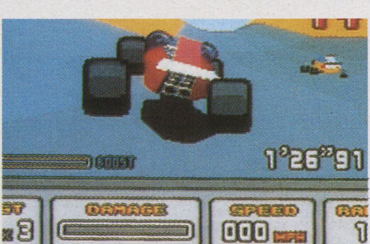
Credits

Producer: Shigeru Miyamoto
Programmer: Giles Goddard
Programmer: Colin Reed
Super FX Chip: Peter Warnes
Super FX Chip: Colin Graham

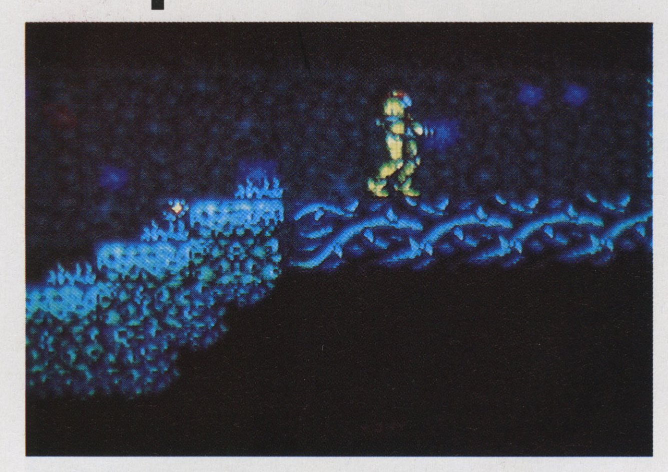
Stunt mode takes place inside a stadium, where large gaps have to be jumped and flags have to be collected



A tunnel looms up ahead. ***Stunt Race FX*** **gives you the freedom to go anywhere – you can even choose to drive over bridges (above right). The Stunt tracks (bottom right) are full of dips, hills and other cars**



Super Metroid



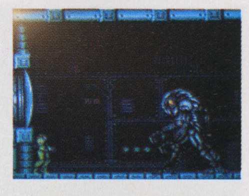
The graphics are hardly what you'd expect from a 24 meg title, but a huge number of levels is likely to be the reason for such a huge cart

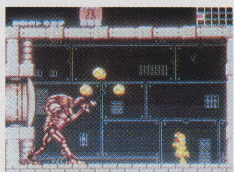
Format: **SNES**
Publisher: **Nintendo**
Developer: **In-house**
Release date: **March (Japan)**
Size: **24 Mbit**
Origin: **Japan**

Metroid – one of the most successful games in America – is set to make a return this Spring in an all-new 24 meg cart.

Basically a huge sprawling platform game with similarities to *Turrican*, alongside *Stunt Race FX* this was Nintendo's other big new SNES game – the words 'barrel' and 'scraping' almost spring to mind. Nevertheless, *Super Metroid* seemed to earn its fans, and American magazines were in ecstasy over it's 'play mechanics' – running jumping and firing, albeit with a few subtleties thrown in like the old favourite, *Bionic Commandos*-style mechanical arm.

The graphics are fairly appealing, if a little, dare we say, Genesis-like in the colour count. But Nintendo still has high hopes for this title – the 24 megabits of memory are an indication of this. Whether it will scale dizzy heights with its gameplay, won't be discovered until March.





Boss characters crop up with alarming regularity in *Super Metroid*. Fortunately, the huge sprawling nature of the game is assisted by a useful map

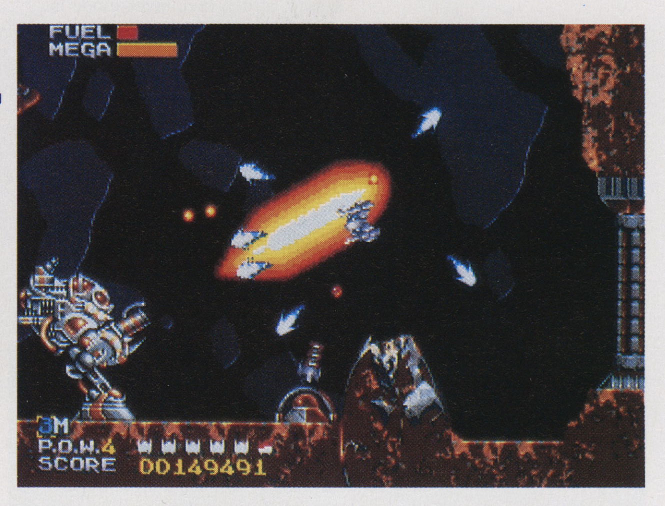
Sub-Terrania



Format: **Mega Drive**
Manufacturer: **Sega**
Developer: **Zyriax**
Release date: **April**
Size: **8 Mbit**
Origin: **Germany**

For spectators of the Saturn demos on Sega's video wall, Sega Genesis and CD software predictably looked a bit dismal. *Sub-Terrania* was more appealing than most, though, featuring some extremely pretty graphics and slick multi-directional scrolling, the game draws heavily from the classics like *Thrust* and *Oids*.

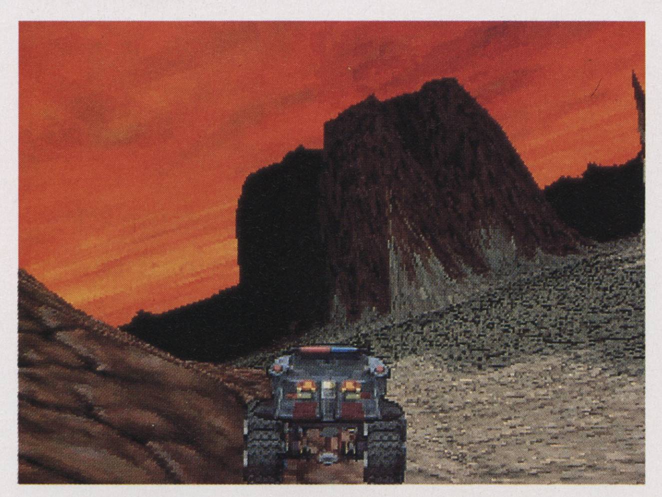
Set within an underground mining colony, players have to rescue trapped miners and destroy aliens, while negotiating the caverns exploring for special weapons, fuel, deposits and shield rechargers. *Sub-Terrania* initially succeeds by delving back into a little exploited shoot 'em up style. For that reason alone, it should be worth checking out in April.



Powerful weapons, great backdrops, and smart enemies – all the things you'll find in this super smooth multi-directional scroller

Later levels feature some truly beautiful scenery: a rare treat for Sega gamers

Orion Off-Road



Using Crystal Dynamics' custom texture-mapped polygon engine – as seen in *Total Eclipse* and *Crash 'n Burn* – *Orion Off-Road* looks smart

Format: **3DO**
Publisher: **Crystal Dynamics**
Developer: **In-house**
Release date: **Summer**
Size: **1 CD**
Origin: **US**

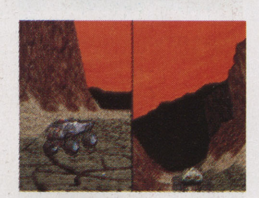
Crystal Dynamics seem to have found a home on the 3DO. CES was the perfect stage on which to show off all their up and coming 3DO products, and without doubt one of their most talked about games was *Orion Off-Road*. Craftily, the Crystal Dynamics design team have taken the same 3D routines from *Total Eclipse*, added a simultaneous two player option and thrown in a couple of off-road racers to make a competitive race game.

But there's a little more to it than that. There's more ground detail in this than in *Total Eclipse*, and you obviously can't fly. But there are canyons to jump and tunnels to hurtle through, as you battle other competitors over the viciously undulating alien terrain.

Scheduled for a Summer release, *Orion Off-Road* looked very smart, even at this early stage.







Just two months into development, and *Orion Off-Road*, already has a strong look. The two player mode (bottom) should provide a few laughs

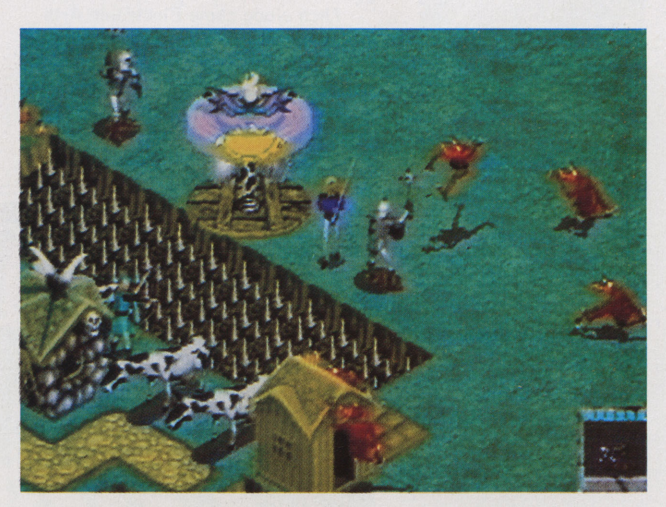
The Horde

Format: **3DO**
Manufacturer: **Crystal Dynamics**
Developer: **In-house**
Release date: **March**
Size: **1 CD**
Origin: **US**

Proving that Crystal Dynamics don't have to rely on beautifully rendered images and fast paced 3D action to sell their games, *The Horde* is an action/adventure title set in an (apparently) humourous medieval fantasy world. The hero, Chauncey, must try and defend his villages against the evil creatures that make up 'The Horde'.

The player isn't limited to just slashing everything in sight: he's also encouraged to create obstacles such as moats, walls and magical weapons to help defend his accumulating land filled with loyal villagers.

Check it out in March.



Looking similar to Micro Illusions' old Amiga game, *Fairy Tale Adventure*, *The Horde* should provide 3DO owners with a challenge



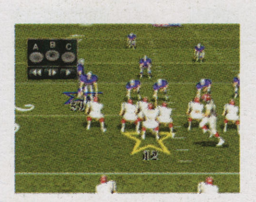


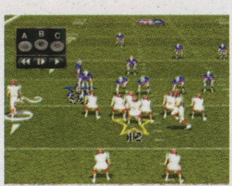
The weird and wonderful world of *The Horde* relies upon Silicon Graphics rendered images (left), and more familiar bitmaps (above)

John Madden Football

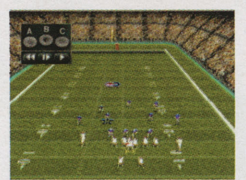
Format: **3DO**
Publisher: **Electronic Arts**
Developer: **In-house**
Release date: **March**
Size: **1 CD**
Origin: **US**

It's the latest and best version of *John Madden* so far. Destined to hit the 3DO in March. Edge tunes in











Watching your efforts has never been so rewarding. During an action replay you can zoom out of the action

Regardless of what some people may tell you, and before *Sonic* was even a twinkle in Sega's eye, *John Madden Football* was the first game to throw out a lifeline to Sega's 16bit machine. It came at a time when the Mega Drive was in dire need of some quality software, a time when every other Mega Drive release was either a poor platform variant or a vertically scrolling shoot 'em up, a time when most people began to think that their 16bit fantasy was indeed just a fantasy.

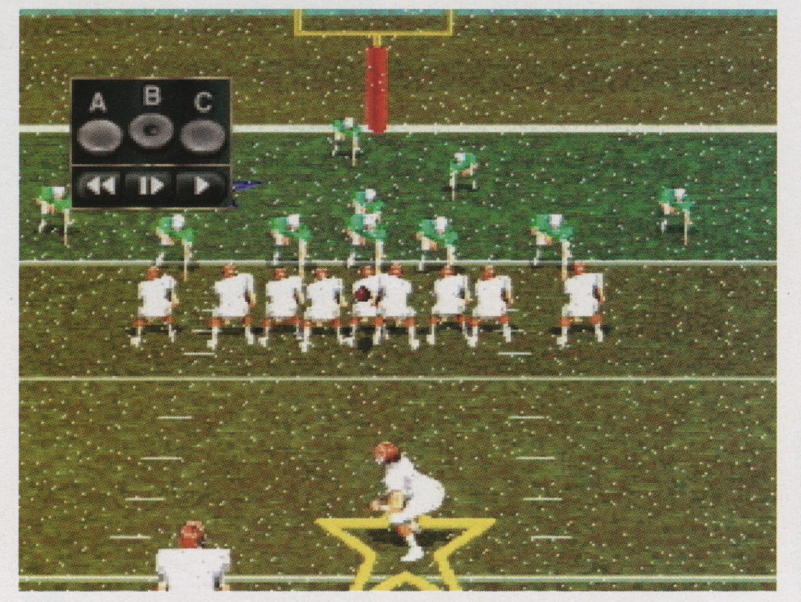
Then along came Electronic Arts who took the rules of a fairly complex American sport, combined some great aesthetics with exciting gameplay, and squashed the whole thing down into a 4 meg cart. It was a huge success, Electronic Arts made loads of money and the Mega Drive survived to tell the tale. Now, four years on, the 3DO system finds itself in a disturbingly similar position.

The 3DO company is hoping that by blending the power of their machine with the programming talents of the EA Sports team, the 'rope of hope' will be thrown out just as successfully this time round.

But what extra features, if any, can 3DO owners look forward to? Well, to start with the whole thing looks and sounds superb. Many sports games have tried to capture the look and feel of the real thing, but never has a game captured the atmosphere of its subject the way *Madden* does on the 3DO.

After waiting what seems like an eternity for the game to load – a

Never has a game managed to capture the atmosphere of its subject the way *Madden* does on the 3DO...



The box in the top right of the screen gives you the chance to control the action replays. This field goal was so well executed it's worth seeing again and again...





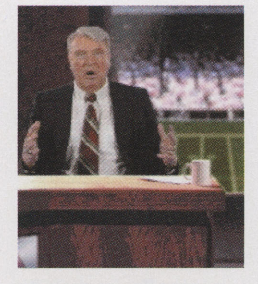
The Buffalo running back tries to break through the Dallas defence (left). He takes to the air (right) in a valiant attempt to get the 1st down



Both teams go into a huddle to decide which play to use next. Judging by this shot, the Buffalo team seem to be a little short on ideas

problem that, we're reliably informed, will be addressed before its launch – the Electronic Arts logo finally appears. In typically American style the logo starts to spin as film footage of American football rolls on in the background. The music reaches a crescendo as 3D rendered models of all the teams' helmets slowly emerge rotating from the bottom of the screen, then disappear off at the top. If ever a game could get you hyped up to play it, it's this one.

A digitised – and highly animated – *John Madden* welcomes you to the game as the option screen appears. You can choose any of the NFL's 28 teams, weather conditions and match length. You can even choose one of the great teams of old: ever fancied taking on the mighty Miami Dolphins of '79? Well now you can.

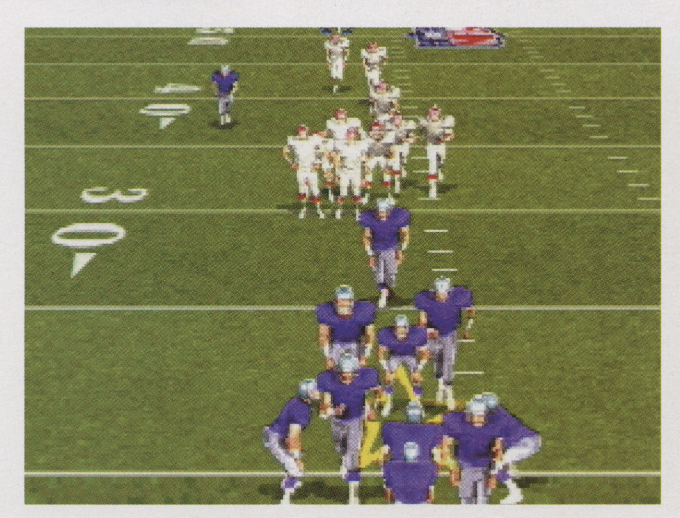


The one, the only, Mr John Madden himself. A big figure in the states. A big figure, period...

The ingame pitch scrolls around very smoothly and all the players although digitised, are surprisingly well animated. Now here's the real surprise: The game actually plays well, very well in fact. The play mechanics are essentially the same as they were on the Mega Drive – only the whole thing looks and sounds a whole lot better. The instant replay feature has also been improved: a play can be reviewed in slow motion, rewound and played fast. But the real innovation is the zoom feature. You can zoom in close to the action or take a bird's eye view of the play – either way, it's impressive stuff.

It's looking very good so far, but we feel there's one problem that needs to be ironed out. In bringing up the passing windows, your view is badly impaired because the windows are so unnecessarily big. It might not seem like a big problem at first but it's one that will most definitely cause all sorts of problems the longer you play.

Let's hope EA can rectify the situation before its release in March, as this has the potential to be the best version of the game yet. E



One of the Dallas players has lost a contact lens as the rest of the team come to his aid. The digitised players work surprisingly well



The Dallas quarterback sets himself up for the match winning touchdown. But be warned, this snow coated pitch is very slippery...

Doom: Evil Unleashed

The sequel to the ultra-gory *Wolfenstein 3D* is here at last. And it looks set to take the PC by storm. Edge takes the plunge…



256 colours, full texture mapping – and the passages in *Doom* move so fast they'll take your breath away. The sound's not half bad either. This is certainly a major step on from *Wolfenstein 3D*

Format: **PC**
Publisher: **Id Software**
Developer: **In-house**
Release date: **Out now**
Origin: **US**

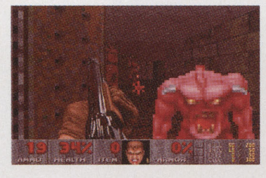
Creators of the seminal *Wolfenstein 3D*, Id Software are no strangers to adjectives like 'stunning', 'superb' and 'classic'. The programmers are probably blasé to the host of similar accolades that have already been bestowed upon the company's latest offering.

To describe *Doom* as a first-person-perspective action adventure would be like calling Blade Runner 'a film about robots'. It has, quite simply, set a new standard for PC games. Just a few weeks out in the States, and it has attracted a devoted following the Dalai Lama would envy. Bulletin boards are awash with information, cheats and speculation.

The fervour with which PC gamers have received *Doom* can be attributed to three achievements, any one of which would have guaranteed its success. First and foremost, it's a masterpiece of technical innovation. The 3D environment is the most realistic ever seen, thanks to 256-colour fully texture-mapped walls, floors and ceilings that move at a rate of up to 35 frames per second on a 486/33. Id claim that 'advanced graphic development techniques' allow game art to be generated five times faster than previously, and the effect is undeniably remarkable.

The consistency and detail of the graphics knocks even *Wolfenstein* into a rather unexceptional cocked hat. Walls are no longer at rigid 90 degree angles and of a consistent thickness; they can even be animated or transparent. Light sourcing is fully implemented, as hallways diminish into darkness, shadows obscure objects and neon lights flicker atmospherically. The slickness with

Just a few weeks out in the States, and it has attracted a devoted following the Dalai Lama would envy…





Death scene: you see red, your vision blurs, you sink to the floor (top). Hideous offscreen snarls warn you of the impending danger...



The Nuclear Plant, where you can expect to meet hordes of shotgun-wielding guards. But this game's all about secret passages and weapons, and there are plenty here

which all this is executed has simply to be seen to be believed.

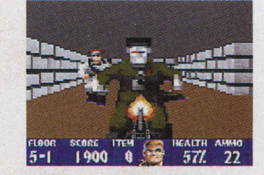
As if this wasn't enough, the second barnstorming feature of *Doom* is its inclusion of multiplayer action. Two adventurers can be linked by a modem or serial connection, and up to four players can participate over a local network. Each player fights, co-operatively or competitively, in the same arena as the others. Id confidently predicts that *Doom* will be 'the number one cause of decreased productivity in businesses around the world', and from our own experiences, we can only agree with them.

The blood-spattered icing on the cake, through, that has cemented its fanatical following, is its excessively violent and at times quite horrific scenario. Using a variety of vicious weapons – fists and shotguns give way to missile launchers and chainsaws – hellish creatures from another dimension are dispatched in the most graphically uncompromising fashion. This no-holds-barred approach to action lends it an unprecedented visceral power that most players have found irresistibly gripping.

Doom is further proof that virtuoso programming skills and playability will always be much more arresting that any amount of CD-ROM hokum. A sequel, using the same engine, story and characters but based on Earth, will emerge at the end of this year. Great things are expected. E

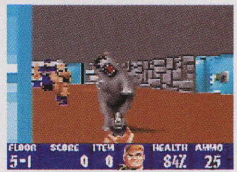
Credits

Programmer: John Carmack
Programmer: John Romero
Programmer: Dave Taylor
Artist: Adrian Carmack
Artist: Kevin Cloud
Designer: Sandy Peterson









And as a bit of light relief, here's a new version of the prequel, ***Wolfenstein 3D***, on the SNES (of all places). Next to the horrors of Doom, ***Wolfenstein*** is a front seat at a Johnny Mathis concert (or something like that...)



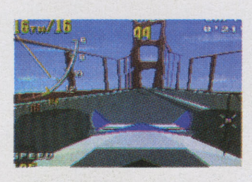


A fire-throwing alien explodes bloodily, yet another victim of your pump-action shotgun prowess (above). Much needed supplies and medical packs lurk on each level (right)

Virtua Racing

Format: Mega Drive
Publisher: Sega
Developer: In-house
Release: June
Size: 16Mbit
Origin: Japan

Virtua Racing is the first game to use Sega's new DSP chip – making it the fastest MD game ever. **Edge** reports






As with the coin-op, *VR* has all four race views: in cockpit (top), behind the car (middle top), above and behind (middle bottom) and an aerial view (bottom). You can select any of these at any time during the game



The starting grid of *Virtua Racing*. The only thing missing from the MD version is the flock of seagulls that flap away in panic

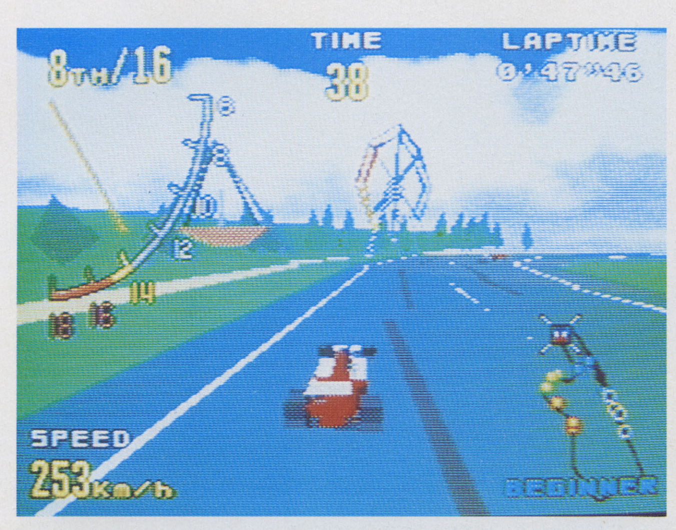
As soon as Nintendo announced its *StarWing*-bound Super FX chip, it was a fair bet that Sega would climb on the bandwagon – or rather, cart. And with *Virtua Racing* doing a storm in the arcades, what better game to convert using their new Digital Signal Processor (DSP) chip?

The new chip is dubbed the SVP – Sega Virtual Processor (rumoured to be an off-the-shelf DSP made by NEC). It's basically a maths co-processor that talks directly to the MD's 68000 and helps produce the 3D polygon graphics. Running at 23MHz, it certainly puts the Super FX chip to some shame, although *Virtua Racing* features no texture mapping so the SVP's full capabilities remain something of a mystery.

Coded by the same team that wrote



Using the aerial viewpoint turns the game into *Virtua Scalextric*. Racing in this mode is tricky but, heck, the scenery is impressive...







All of *Virtua Racing*'s scenery has been ported over to the Mega Drive version – including the spinning fairground ferris wheel (above). Before starting a race, you can sit back and watch the demo mode (right). This shows off the 3D graphics to their full, with swooping 'camera' shots

Coded by the same team that wrote the coin-op, MD *Virtua Racing* has all the features of its arcade parent...

the *Virtua Racing* coin-op code, MD *VR* has all the features of its arcade parent – and then some. You can practice and race on all courses, the four-viewpoint option has been retained, and Mega Drive owners are also treated to a splitscreen twoplayer mode. And everything moves at a perceived racing speed faster than the coin-op – although the SVP is handling a lot less polygons than the 180,000/sec of the 32bit cabinet.

One of the more astonishing inclusions is the full replay option. Finish first within the time allotted and you can sit back and watch the entire race from a series of cameras dotted around the course. All the more impressive when you think that races last between four and six minutes!

As with the coin-op there are three different tracks, but a clever system allows any of these tracks to be played as its mirror image – so every right turn becomes a left turn; buildings on the left now appear on the right, and so on. This effectively gives you another three tracks to race on.

Virtua Racing is very fast and very smooth: even on a 50MHz PAL version, the screen update whips along. The SVP easily puts the MD's performance into the 486 PC bracket.

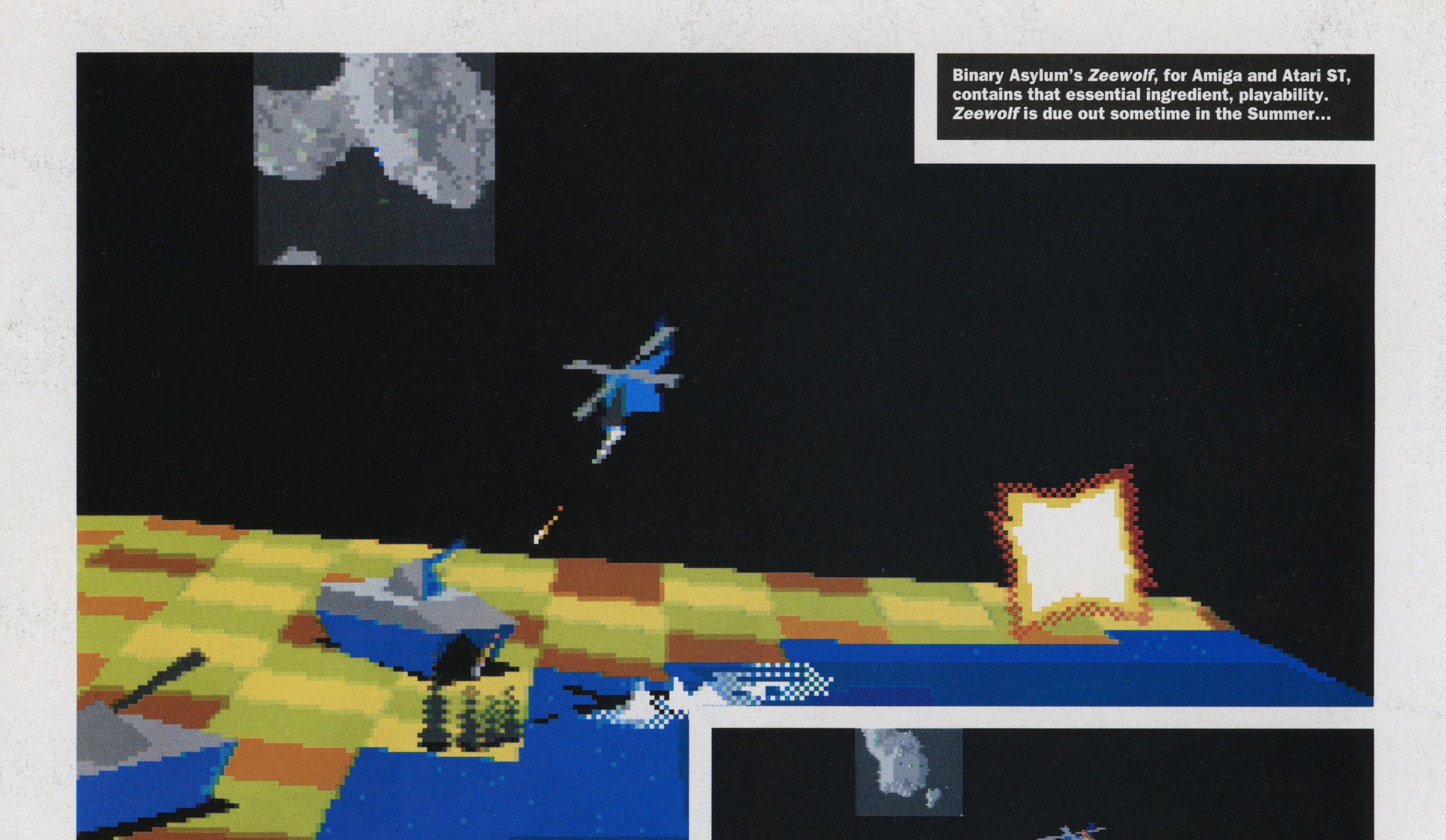
The only question mark remaining is about the price tag, which is hovering around the £80 mark. Still, it's a darn sight cheaper than the £12,000 arcade machine...



With the cockpit view, you also get to see your virtual driver's hands. (He might be a great driver but his piano playing isn't up to much)

Chip comparison

	SFX	SVP
Command set	RISC (1 instruction per cycle)	DSP (1 instruction per cycle)
Operating speed	10MHz or 10 Mips	23MHz or 23 Mips
Multiplication processing speed	8x8bits/cycle; 16x16bits/4 cycles	15x15bits/cycle
Division function	Included, estimated at 16 cycles	No division function, software operated at 32 cycles
Polygons/second	100-120, 16 colours, 4 interrupts	300-500, 16 colours 4 interrupts
Bus bandwidth	Internal 16bits/external 8bits	16bits/16bits



Binary Asylum's *Zeewolf*, for Amiga and Atari ST, contains that essential ingredient, playability. *Zeewolf* is due out sometime in the Summer...

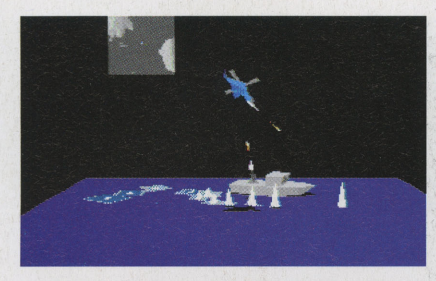
Binary Asylum

Developers Binary Asylum have mixed technology with traditional gameplay to create their first product, *Zeewolf.* **Edge** takes an early look...

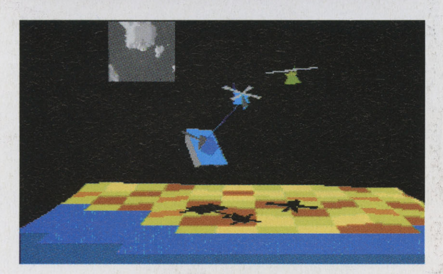
It's a sad fact, but many of the games released today just rely on coupling seductive rendered visuals and pounding soundtracks, with very simplistic 'point and click' gameplay.

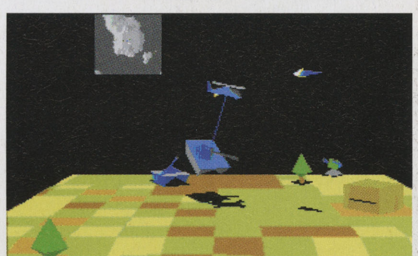
Developers seem to have forgotten about the games that helped to make the software industry the thriving business place it is today. When was the last time you can remember seeing a really playable game? A game that in being so engrossingly playable, totally separated you from reality.

Unfortunately, the playable game is fast becoming an endangered species. But wait,









The *Zeewolf* helicopter attempts to take out a boat (top two pictures) but, as you can see, the boat is masterfully avoiding getting hit. The bottom two pictures show off one of the game's strongest points: you are often called upon to pick up your tanks – it can be done in real life – and drop them into enemy territory. The feeling of inertia is incredible. *Thrust*, here we come...



Andy Wilton (left) and Andy Smith, hard at work developing their chess skills. Both of them believe that there's still a market for playable games. The nerve of some people, eh?

Zeewolf is a game that builds upon the best elements from classic 'playable' titles of the past and brings them all together in one package. Bath-based software developers, Binary Asylum have taken full advantage of the current software trend and in doing so look set to join Sensible Software and Bullfrog in the fight against unplayable software.

The more observant will notice that *Zeewolf* bears more than a passing resemblance to David Braben's *Virus*, but there the similarity ends. Asylum PR manager **Andy Smith** is adamant this is not a *Virus* rip-off: 'We're all *Virus* fans here, and this perspective is essentially very similar, but *Zeewolf* is an entirely different game.'

Although using a similar perspective to *Virus*, *Zeewolf* does indeed play differently. It's like a cross between *Defender* and *Choplifter* and contains the same sort of gameplay that made *Thrust* so successful.

Your job is to fly a helicopter through 32 missions, most of which revolve around rescuing people from various locations and taking on the enemy force.

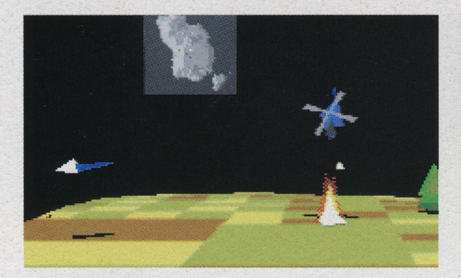
Zeewolf is a game that builds upon the best elements from the classic 'playable' games of the past...

Control of the helicopter is crucial, especially with this three dimensional viewpoint, and thankfully Amiga programmer **Andy Wilton**, has created a very user-friendly system. Using the mouse, the *Zeewolf* can be lowered, raised and spun around with comparative ease. You have the freedom to take the helicopter wherever you like, whenever you like – the game does not restrict you in any way. Similarly, you can tackle each mission in any way you like.

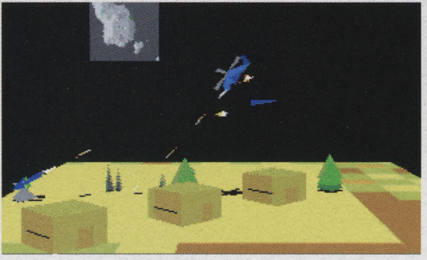
To ensure that the game moves quickly and smoothly, Andy Wilton spent over five months creating a polygon engine. *Zeewolf* is running 32 colours at 17 frames a second. The entire polygon engine takes up only 100K of code, thus leaving plenty of room for everything else – missions, different enemies, etc.

He explains: 'It's unusual to have a game on the Amiga running 32 colours at 17 frames a second. Most people have to drop the number of colours to save power. But due to this new engine, we don't have

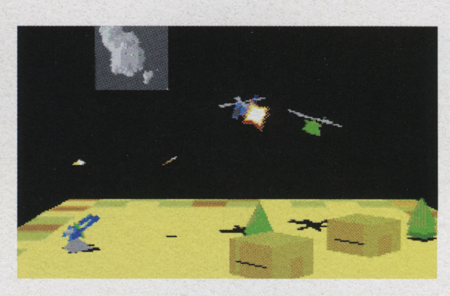
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A missile heads towards the *Zeewolf*, so some deft evasive action is required



The *Zeewolf* strafes an enemy base with ease – but you must always remain on guard...



... as the enemy can radio for help at any time. The hunter suddenly becomes the hunted

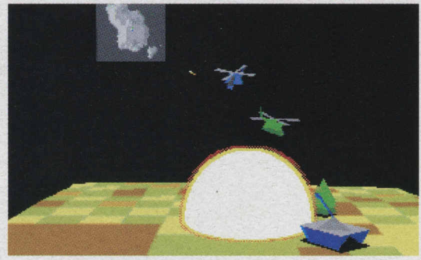
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to drop anything.'

Unlike many polygon-styled games, the trick here was to use as few polygons as possible. According to Andy, 'It's how few polygons you use and still manage to build an interesting shape, not how many hundreds of polygons the shape has got.'

The helicopter in *Zeewolf*, although realistically animated, only takes up 10 polygons. 'I don't mean 10 polygons visible at any one time, I mean 10 polygons fullstop', he emphasises.

Although reluctant to give away many of his programming secrets he did point out that his polygon drawing code is very, very specific and that he's using sheer brute force to get the speed of the game up.



Andy Wilton is particularly proud of his 3D sphere routine – used for explosions (left) and power plants (right). The sphere is clipped properly even as it passes 'through' the screen



Jim Gardner – an experienced conversion programmer – is responsible for converting the game for the Atari ST. He enthuses, 'I've seen many 3D routines before, but I don't think anyone will do it much better than this.'

Jim's also experimented with a Mega Drive version, 'I've got the system up and running on the Mega Drive but we don't know if we will go through with it. Let's just say we could do it if we had to.'

Zeewolf is going through the final stages of development and should be out some time in the summer.

It's all based undeniably around some pretty classic gameplay. According to Andy Smith, '*Zeewolf* contains elements of great games simply because those were great games. The consumer today thinks a game needs great graphics to be any good, but we feel there are enough people out there who want good solid games.

'If you look at today's console kids, how many of them have played *Thrust*? Yet there's no reason why something as playable as that won't work as well today.'

It remains to be seen whether *Zeewolf* will make an impact the way the games it's based on did. But as Andy himself says, there's no reason it shouldn't.



Binary Asylum are (from left to right): Andy Smith – ideas man and PR manager, Jim Gardner – ST conversion programmer, and main Amiga programmer Andy Wilton



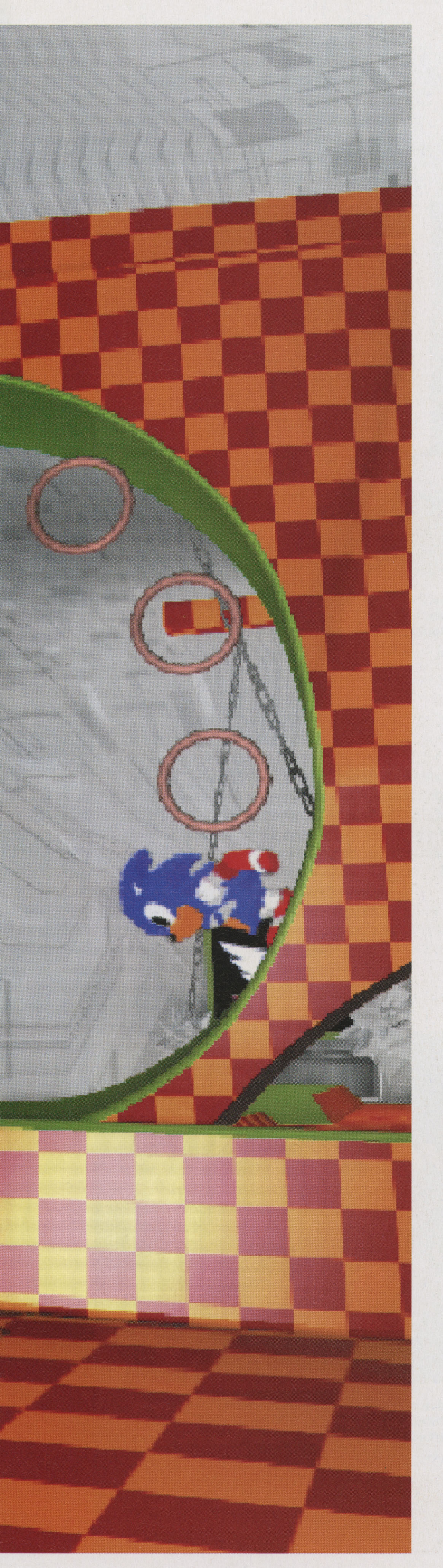
Credits

Amiga programmer: Andy Wilton
ST Conversion: Jim Gardner
PR manager: Andy Smith
MD: Bob Wade


BRAVO
TIMEWARP
TELEVISION

Image: **Marcus Morgan, Courtesy of Virtual Image Ltd**

***Sonic 3D*? Actually, this 16.7 million colour image was created on a standard PC using Autodesk's *3D Studio*. But it's only a question of time...**





Games in another dimension

Edge takes a look behind the scenes of the latest 3D images



ore and more games, both on home systems and coin-ops, are moving into ultra-realistic 3D settings. Just consider newies like *Ridge Racer*, *Virtua Fighters*, *Total Eclipse* on 3DO, *Doom* on the PC, if you're in any doubt. And the new systems – Sega Saturn, Sony PS-X, Nintendo Project Reality – will all contain dedicated 3D graphics engines. There's no doubting that the next generation of games will take place in the third dimension.

So, **Edge** thought it was time for an analysis of just how these stunning 3D images are brought to our screens. And thankfully you won't need a degree in pure maths to understand how it all works. In fact it's often all just a matter of three simple numbers...

You're probably aware that you can define any point in three-dimensional space by a set of three coordinates: X, Y, and Z – the equivalent of left/right, up/down and forwards/backwards.

3D uses lots of points, defined by three dimensional coordinates, to build objects. For example, define four corners of a square, and you've nailed down the exact position of an imaginary square floating in space.

You probably already know that 3D games are based on polygons. But many people forget that polygons are flat shapes, like squares or discs – not solids, like cubes or spheres. To make up a cube for a 3D game, you'd use six polygons, one for each surface of the cube. That's six polygons, each defined by four sets of three coordinates, just for one simple object.

So to build up the artificial reality of a 3D game world is technically quite straightforward. All you have to do is define sets of coordinates for the objects in the game – planes and buildings in a flight sim, for example – making sure to build all your objects out of flat shapes.

One thing that should immediately

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featureview: 3D



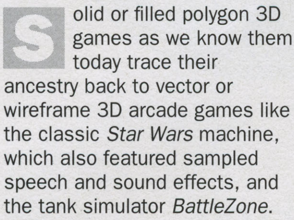
The as-yet-unseen *Forgotten Castle* uses full texture-mapping and depth-cueing to astonishing effect



Id Software's *Doom* shows off its 3D engine. Here you can see through three separate windows to the mountain scenery outside. You can even shoot through windows and doorways and make kills in adjacent rooms



Ultima Underworld 2 again uses depth-cued texture-mapping to turn polygons into corridors



Solid or filled polygon 3D games as we know them today trace their ancestry back to vector or wireframe 3D arcade games like the classic *Star Wars* machine, which also featured sampled speech and sound effects, and the tank simulator *BattleZone*.

But the game that really put the seal on it was David Braben's *Elite* in 1984. For home computers a new breed of games emerged which, because you didn't have to put coins in, had no limits on time spent playing. Braben combined this with the benefit of 3D methods to create the first believable game world: you literally had a whole galaxy to explore.

For most of us, the first encounter with solid 3D was Geoff Crammond's *Revs* on the BBC in 1985. From then on, and especially as new machines like the Amiga and Atari ST appeared in 1986-7, filled 3D had pride of place as the ultimate in advanced gaming. Braben even got his hands on an early 32bit Archimedes to produce the weird *Zarch*; truly an acquired taste, but lauded by many as the finest game ever created, even in its Amiga/ST incarnation as *Virus*.

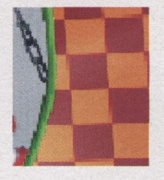
While Incentive's explorative adventures using their Freescape system brought 3D to the 8bit masses, during the course of 1988 it was 16bit 3D that remained the coolest in computer gaming. Crammond released *The Sentinel*, Realtime produced *Carrier Command* and Jez San's Argonaut team produced the splendid but shallow *Starglider 2*.

Flight sims were a part of this spearhead, and *Interceptor* (June 1988) is credited with selling more Amigas than Commodore's marketing campaigns ever could.

But slowly, as console platform games took the limelight, the profile of 3D began to slump. The Assembly Line's *Interphase* in November 1989 was still at the sharp end, but by the time the same team's *Cybercon III* was released in March 1991 it was heralding the end of the Amiga's 3D rule.

What was happening was that the top 3D teams were moving on, in search of new goals like true light-source shading, texture-mapping and Gouraud shading, which meant a need for extra processing power. Already the experts were saying that before long we'd have consoles

Continued



become obvious is that nice, curvy objects are difficult to model in 3D. For a good, smooth curve you need lots of points, so the smoother a curve you try for, the more points you need. And when it comes to doing anything with your objects later on, all those points will have to be dealt with by your calculations.

And that, simply enough, is why 3D games tend to look blocky, and why they've become more realistic with increasingly powerful machines. Balancing speed against the level of detail is one of the most difficult tasks for a 3D game designer.

To define all these coordinates for your objects, you need a reference point – what you might call 'absolute zero', the coordinate (0,0,0). You might expect this to be somewhere in the gameworld, but in fact it's not. There is no single point that all objects are defined relative to. The polygons for each object are defined relative to its centrepoint, so each object has an extra coordinate. Which means each object is self-sufficient.

This makes it much simpler to design the objects. They can all be built individually, and thrown into the gameworld as the game builds up. Most of the 3D programming teams have developed their own 'object editors' which they use to build their objects.

Another consequence of this is that the whole of a gameworld is not in existence all the time: just the bits of it that are relevant to the player at any particular point.

This, again, means that you don't have to calculate everything all the time and so it



The 7th Guest is one of those games that cheats. All the 3D graphics are rendered a frame at a time on PCs running *3D Studio*. The linked frames are then merely displayed during play



A polygonised officer Murphy struts his stuff in Ocean's odd, but well-received, *Robocop III*



Taking the opposite route to the *Underworld* games is *Alone In The Dark* and its sequel (above). Here, scenery is predrawn and the characters are represented by polygons. The animation is surprisingly fluid and realistic



Out Of This World is a sort of flat *Alone In The Dark*, using 2D polygons to animate its characters

with built-in hardware for drawing 3D, but in the meantime the PC would be where it was at.

Back in 1991 Electronic Arts were at the forefront with their *Chuck Yeager* flight sim, where texture-mapped detail provided realistic fields and hedges to rush past underneath your plane. Texture-mapping was taken to its logical, and jaw-dropping extreme with *Ultima Underworld*. Underground dungeons were presented using polygon technology, and full depth-cued texture-mapping completed the illusion.

As texture-mapping became more and more commonplace, 3D designers turned their attention to the problems of Gouraud shading.

In 1992, Microprose's *Harrier Jump Jet* had arguably the first successful use of Henri Gouraud's algorithms. *Reach For The Skies* followed, using Gouraud shading on the planes.

PC simulations have remained at the forefront of 3D, and the latest titles, such as Novologic's *Comanche*, and Cyberdreams' *CyberRace* have introduced gamers to the concept of 3D pixels, or 'Voxels' which can be viewed onscreen from any angle.

But recently some of the big names in 3D have taken refuge in the past: while Braben worked painstakingly for several years on *Frontier: Elite II*, Crammond said goodbye to the Amiga with the astonishing *Formula One Grand Prix*, a *Revs* for the 90s.

Argonaut, meanwhile, decided that they would come up with their own solution to hardware limitations and cooperated with Nintendo to create the chip which runs *StarFox*, the most advanced example of 3D you're likely to see on the Super NES.

At the moment, the revenge of the arcades is under way. With the exception of Atari's *Hard Drivin'* – a huge arcade hit in 1990 – and Microprose's own *Strike Eagle*, coin-op machines have done little for the 3D cause. But the latest generation of machines from Namco, Sega and even Konami now generate superb texture-mapped complex images, generated real-time at extremely high speeds. And technology as powerful – if not more so – will be in the home by the end of the year.

Sony's PS-X technology is already being licensed for use in coin-ops – it's *that* powerful. And Nintendo have also nailed their flag to the 3D mast with their →



Sega's *Virtua Fighters* doesn't do anything cleverer than *AITD*. What it does do, though, is generate more polygons, faster. And with beat 'em ups, speed – and response – is of the essence

speeds up the game.

Right. So our object appears in the gameworld when it is required, and not before, according to where the player is in the game. Its centrepoint is defined by a set of coordinates relative to the player, and its shape is defined by coordinates relative to the centrepoint.

The unit of time in a 3D game, just as in a bitmap game, is the frame rate: every time the screen is drawn. Bitmap games nowadays tend to aim for a frame rate of 50 frames every second, but 3D games get away with a much lower rate than this; 12 is quite normal, but often as little as eight is perfectly acceptable.

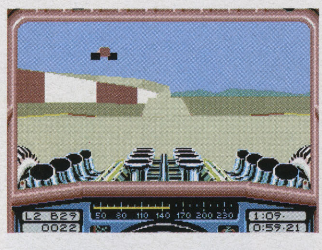
Because there is so much to do in between each frame, with shape-heavy scenes the polygon drawing can slow down the frame rate unacceptably. And as in any other game, the functions of movement of objects and collision detection must be handled between each frame draw.

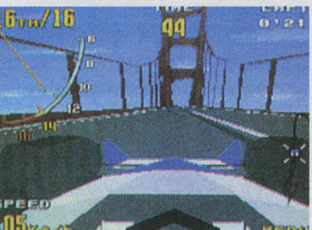
Collision detection is essentially the same as in any other game – a comparison of the coordinates of all the objects, to see if any are overlapping. The danger is of having too many checks to do. If you have only 20 objects in a game, that's 400 checks to be done, so the game designer has to find ways of checking only the ones that really matter. There's no way of short-cutting collision checks mathematically: you just have to design around the problem.

Movement of a 3D object is simple; the movement pattern is defined as a vector which is simply added on to the coordinates that define the position of the object's centrepoint relative to the player.

Naturally, it's also possible to create a complex pattern, like an object that goes

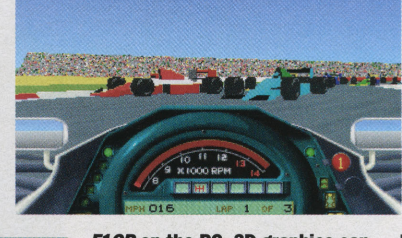
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Racing games are a prime target for 3D, as there is almost no other way of effectively showing the action. One influential game was ***Stunt Car Racer*** (top left): basic graphics but an overwhelming sensation of movement. ***Virtua Racing*** (above left) and ***IndyCar Racing*** (above) both use 3D to view the race from a variety of angles



F1GP **on the PC. 3D graphics can recreate the entire racecourse and allow you to drive anywhere**

recent agreement with Silicon Graphics – *the* leading edge in computer generated imagery. A 64bit system based on SGI's proprietary chipsets should be mindblowing.

To prepare you for the 3D onslaught, what follows is an explanation of many of the technical terms that do little but cause confusion…

Imitation light source

Generally in a game, all the objects tend to stay the same way up. This means that if you wish to give them the appearance of being shaded as if the light source was directly overhead, all you have to do is make sure when you design the colouring of your object, you make the panels on the underside a darker shade than those on the top.

Shadows

Shadows on the whole are simply not bothered with, but where they are implemented, the way of doing it is usually to simply create a dark object from a few polygons. You then move it the same way as the object, though constraining it in the Y (vertical) axis to a single plane, that of the gameworld's 'floor'.

You can also do calculations based on dividing by the Y coordinate of the object that the shadow is of, so that as the object rises, the shadow gets smaller.

Light-source shading

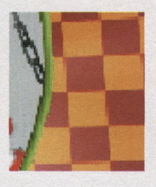
For any kind of light source to come into play, a vector needs to be attached to each polygon. This vector represents a line from the centre of the polygon at right angles to the plane of the polygon, and is called the 'surface normal'.

The vector for each polygon is compared with a vector that represents the direction of the light (called the 'angle of incidence'), and the colour of the polygon is modified accordingly. Generally, only three or four different shades of the base colour need to be used for a whole object.

Gouraud shading

Named after its inventor, Henri Gouraud, this type of shading has the advantage that it

Continued



round in circles, by simply modifying the movement vector for each new frame you create.

Movement for the player is only slightly more complicated. The player's input with the mouse or joystick is converted to a vector for movement – this is made a good deal simpler by the fact that it's likely to be in only one axis only.

Since the movement is relative to the objects in the game world, this vector must then be applied to all the objects to make it a movement relative to the player. But naturally, what's applied to the object is the exact opposite of the player's vector.

In other words, if the player moves two steps closer to an object in the X direction, that is the same as taking two away from the X value stored for the object's centrepoint relative to the player.

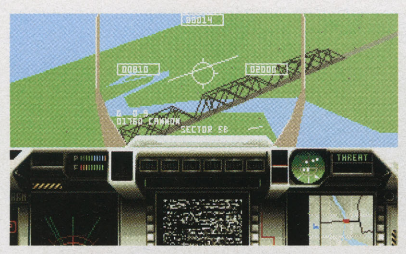
There is, however, another kind of movement to be dealt with. It's possible for the player to change his viewpoint relative to the gameworld without actually moving his position: by rotating.

The way it's done is actually simple enough, with all the objects rotated by the opposite of the player's rotation: it's just that a rotation calculation is slightly more complex, because it involves subtracting from one axis as you add on to another.

Finally, one last aspect of movement. It's possible that as an object moves, you may require it to change its orientation relative to the player. An enemy airplane, for instance, might bank, tilting sideways, and turn away as it flies away from the player. Changing the orientation means you have to alter the coordinates of all the polygons in an object relative to the centrepoint of the object, so

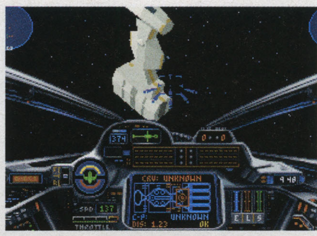


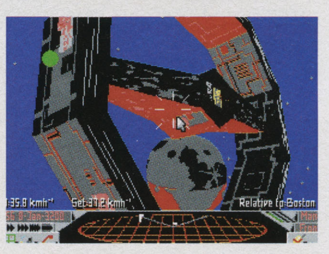
***Ridge Racer*'s astonishing roadways are made up of texture-mapped polygons. Namco's System 22 hardware represents the state-of-the-art in 3D coin-op technology – for the present…**



***F-29 Retaliator* is a classic example of balancing object detail against frame rate**







Air and space combat simulations profit from the freedom of movement that 3D graphics can impart. *TFX* (above) manages to maintain a high frame rate, even with complex, Gouraud-shaded craft. Combat in space – as with *X-Wing* (top right) and *Elite* (above right) – benefit from having no ground to render

appears to smooth off the corners of rounded objects. However, it takes a lot of processing and so has only become possible over the last couple of years on fast PC systems, and is mainly only used in flight sims.

It works like this: the usual surface normals for the polygons are taken; then 'vertex normals' are calculated by taking the average of the surface normals. These vertex normals are then given a shading value by comparing them to the angle of light, just as the surface normals are in standard flat shading.

Phong shading

Named after its inventor, Phong Bui-Tuong, this method is more realistic for doing curved surfaces like spheres than Gouraud shading is, because instead of shading each polygon in straight lines, it shades them in curves.

It is, however, a good deal more complex and extremely costly in terms of processor time, because it calculates extra 'normals' for every single one of the pixels on a polygon, so it's not yet been used in real-time games.

Raytracing

Some day, as you search the skies for the MiG fighter you know is lurking there, you'll be able to catch the brief flash of light as its wing reflects the light of the sun.

Full raytracing requires far too much processing power to be plausible as a real-time operation – but we can dream.

It works like this: every object's surface is assigned not only a colour but also a value for how well it reflects light. The software then traces back beams of light, starting from the surface normal of every pixel of the last object the light hits, seeing what other objects the light bounces off on the way.

Each of the pixels the ray hits along the way has its colour modified according to how reflective it is, and what the colour of the previous pixel the light ray hit was.

True texture-mapping

Currently the preserve of advanced 3D modelling →



***Comanche: Maximum Overkill* is just that. The graphics – using Voxel technology to create the undulating scenery – are an astounding testament to the ingenuity of 3D programmers**

though it's simple enough in concept, it does add a lot of extra calculation.

But once you can handle the movement of all the objects, you can start drawing the screen display.

As we've said, the polygons in the object are defined relative to the centrepoint, and these are held in a matrix. First task is to relate the polygon to the player's position. Next comes the perspective calculation, which turns the 3D X, Y and Z coordinates into 2D X and Y coordinates. This sounds like it ought to be terrifyingly complex but is in fact quite simple.

For each vertex, the 2D X coord will be the 3D X multiplied by a constant (a set figure, put in to make the result more manageable) divided by Z; and the 2D Y coord will be the 3D Y multiplied by another constant divided by Z. Think about this: all you're really saying is that the further away something is (therefore the greater the Z coordinate), the smaller the end result will be. Objects appear smaller as they get further away.

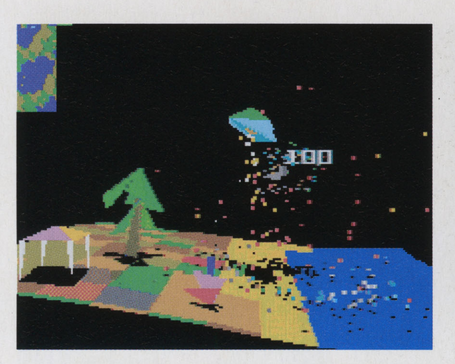
You have to multiply by a constant to make the figures more manageable and you also have to add on the centrepoint of the screen but that's all there is to it.

What we're left with now is a set of 2D coordinates defining the shapes of the polygons as you actually see them. So what was previously defined as a square at an angle to you, now becomes whatever it will look like onscreen.

What follows, before we can finally get our screen display, is the most complicated piece of programming in any 3D game. And although you might have thought all that handling of complex 3D objects would be pretty expensive in terms of processor time, it's the remaining bit of the work that still takes up most of the

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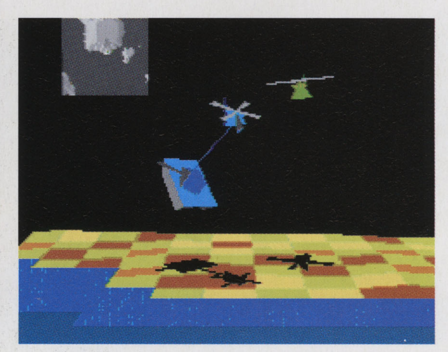
featureview: **3D**



David Braben's classic *Virus* uses the 'tabletop' landscape system, which keeps the player's ship central and slides the land around beneath



The same graphics engine was then used to good effect in *Conqueror*. Here, the player takes control of a battletank



And now the best of both worlds has been incorporated into *Zeewolf*. Binary Asylum's 3D engine is faster and more colourful

packages like *3D Studio*, this was the technique used to create the robot models in *Rise Of The Robots*.

A bitmap screen painting can be wrapped on to the surface of a 3D model, thereby adding extraordinary levels of colour detail, and can then be rendered using raytracing techniques.

Scaling as imitation texture-mapping

True texture-mapping requires that every single pixel on the surface of a polygon must be rotated individually, so it takes a truly enormous quantity of processing – far too much to actually do in real-time.

Within the last couple of years, games have appeared – particularly adventures like *Wolfenstein 3D* on the SNES – which use a kind of texture-mapping to build the scenery. In actual fact, this method can only be used to detail, say, the walls of a dungeon – not the floors, nor the ceilings, and not more complex objects. That's because the scenery is made up of blocks of bitmaps which are scaled to make it appear as a 3D plane.

Polygons as imitation texture-mapping

If your 3D routines are efficient enough, and you have enough processing power, when you want to put details on an object you can simply do it by using extra polygons. This is often used for details on airplanes in flight sims, or cars in a driving sim. It's a lot more efficient than true texture-mapping because even if you double the amount of objects on your screen, you still don't have to calculate every pixel of every polygon.

This is also the technique used by the most advanced recent Sega arcade games which haven't cracked the art of texture-mapping.

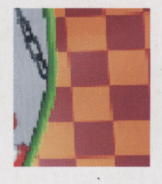
Bitmaps as 3D objects

It is possible quite easily (and there are graphics programs on the market that do it) to convert a bitmap to a 3D object which can then be treated as any other object in a game. So it is that quite strange objects that look almost exactly like texture maps are included.

Depth-cueing

An extra tinge of realism can be added by making objects darken as they appear to be further away. When an object first appears in the distance, it is very often represented by a much simpler set of polygons, because drawing the whole complex object would still only result in a few tiny pixels and would take much more

Continued



time in 3D videogames.

First you have to handle a process called 'sorting' (or backplane removal), which involves working out which of the faces of an object you can actually see. If your object is a cube, for example, you will only ever be able to see three of its six faces: the polygons at the back are hidden.

The simplest way of sorting involves defining all the points in a polygon in a clockwise order. If, after the polygon is converted to 2D, all the points are still going clockwise, then it has its face forwards and needs to be drawn. If the points are now going anticlockwise, the polygon has its back to you so does not need to be drawn.

There are, however, problems at other stages of the process, and so this simple technique is rarely used: more complex techniques tend to remain trade secrets. Worse still, sorting is simple enough if your object is convex, like our cube, but is vastly more complicated if your object is concave or if it has holes in. No-one used to use convex objects, but some of the top 3D teams came up with clever ways of dealing with them.

Similar to sorting is the next process, where you have to decide which of the many objects in your field of view actually get drawn on the screen. Obviously, some will be closer to you and will hide or overlap the ones that are further away.

At this stage a piece of code sometimes known as a 'painter algorithm' comes into play: it's so called because it draws the objects that are furthest away first, then paints over them with the nearer ones. All this is done in the screen buffer before the screen is actually displayed.

One such technique, which also covers sorting, is called 'Z-buffering', where a separate memory buffer is used to store all the Z values of the polygons as they are converted to 2D, and each pixel is then checked to see if there are other pixels that share its X and Y values before the one with the lowest Z value is drawn.

If a polygon is too big to fit on the screen, and disappears off the side, top or bottom, it has to be cut down to fit the screen. At the end, if a simple four-cornered shape goes off the top and the side, you might end up with a new polygon that has six corners.

The simplest way to cut it down is with a technique known as clipping. You simply feed each polygon through a number of steps that cut off the top, sides and bottom – though most people use more advanced techniques.

Some programming teams use sophisticated drawing routines that are capable of leaving out the clipping of the X axis altogether, making sure that each horizontal line of the screen display starts and stops drawing polygons where it should, but ignoring whatever part of them



The Super FX chip dragged Nintendo into the 3D age: *StarFox* also features bitmap backgrounds



Total Eclipse is a good example of games played 'on the rails', where the player's movements are restricted. They're simpler to code, since you don't continually have to keep track of every object in the gameworld



The futuristic *CyberRace* – like *Comanche* – uses Voxels to generate its stunning scenery

calculation. By the same token, using the Z coordinate as a key, the object can be made several shades darker in colour – which, in a similar way to atmospheric perspective, adds the impression of distance.

Atmospheric perspective

A technique similar to that used by artists, who know that the nearer the horizon an object is in daytime, the paler it appears. Objects can be shaded lighter when they first appear in the distance, using the Z axis as a key, but it's also common nowadays to shade the sky, and very often also the scenery, in flight sims so that they pale towards the horizon. This is a simple raster-line function that shades the solid colour of the sky or floor, and so requires no 3D work at all: it's just the same as simple shading in a bitmap game.

Fractal mapping

Fractals are often used to generate landscapes, but seldom in real-time, though the technique is beginning to appear. Fractal landscapes are built out of triangular polygons, in roughly the following fashion. Imagine you have a triangular piece of paper and draw three lines that meet at the centrepoint of the triangle. Now imagine your paper is infinitely mouldable, and that you raise the centrepoint to a specified height: then repeat the operation on the three triangles that now form the sides of a pyramid, raising their centrepoints to slightly below the height of the first: and so on, repeating the process as many times as necessary to get the required level of detail. The advantage of fractals is that as the player gets closer, a new level of detail can be calculated in real-time, so that objects appear to get more detailed.

Bitmap objects in 3D

An increasingly popular idea is to use bitmap images for the objects on a 3D surface. Because the objects have a 3D position, they can be scaled in relation to their Z axis: but because they are not genuinely 3D themselves, you cannot 'walk round them' and see a different side of them from any angle.

The advantage is that such bitmap objects need no calculation beyond the sizing, and that they can be as detailed as you like without the need for texture-mapping calculations. **E**



Cybermorph makes full use of the Jaguar's built-in Z-buffering, which allows 3D objects to be easily displayed in relation to one another – sitting on top of or even intersecting other polygons

appears above or below the screen.

The last piece in the jigsaw – and by far the most important – is the polygon filler. This simply runs along each horizontal line of the screen display in turn, drawing in each pixel of every polygon and working its way down the screen. The polygon filler is the most complex and time-consuming of all, and it's when custom polygon fillers appear in hardware that 3D systems will really come into their own.

Having carefully avoided it up until now, we've got one final complication to mention: and that's what's known as 'Z-clipping'. The problem occurs back at the 3D stage, when you have an object partly in front of the screen and partly behind it. You can see some, but not all of it. A few of its Z values will be positive and some will be negative, and that causes all kinds of problems if you just throw it into the perspective calculations.

What you have to do, therefore, is clip it as a three-dimensional object, lopping off the bit that's sticking out of the screen and producing a new 3D polygon that has only positive values and can safely be passed to the perspective calculation. It's tricky to do well, and still an area for some hard thinking by 3D teams.

And that, in a nutshell, is all there is to it. Hopefully we've gone some way to demystifying the black arts of 3D.

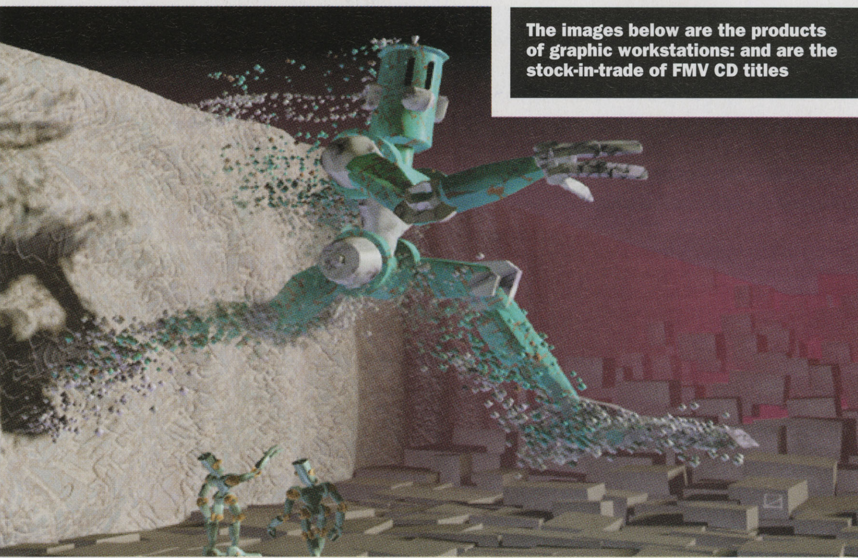
Of course, the actual application of these techniques is up to individual programming teams – and there will always be variable quality 3D games out there.

But whatever happens, and whichever new machine we finally end up playing on, 3D looks certain to be the language of the future. **E**

featureview: 3D

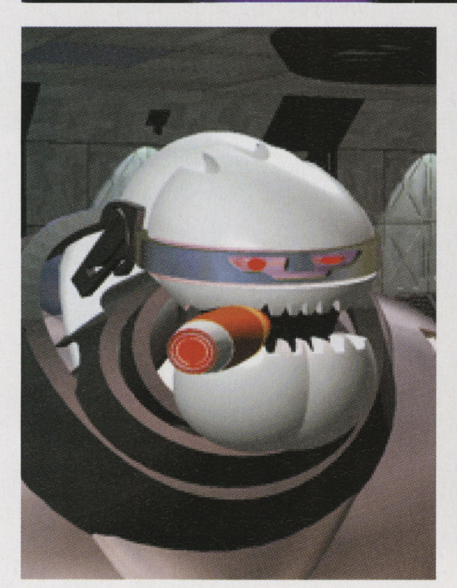
The images below are the products of graphic workstations: and are the stock-in-trade of FMV CD titles



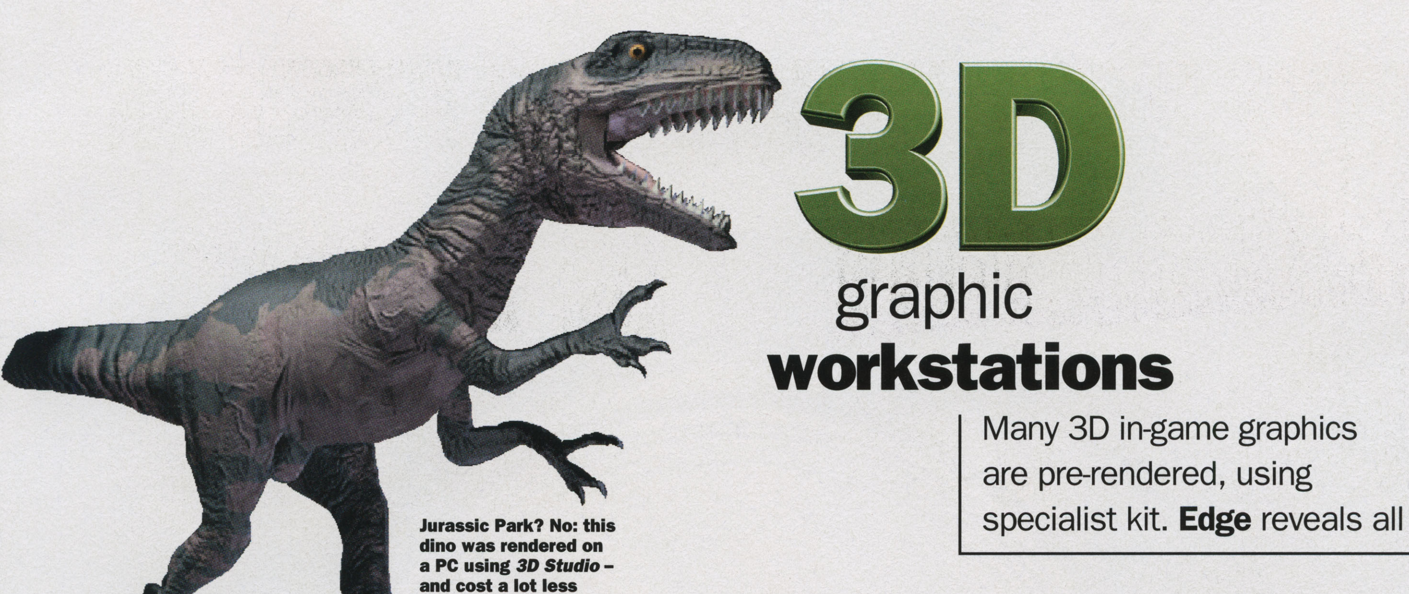












Jurassic Park? No: this dino was rendered on a PC using *3D Studio* – and cost a lot less

3D graphic workstations

Many 3D in-game graphics are pre-rendered, using specialist kit. **Edge** reveals all

Autodesk

There are two main options for creating professional graphics. The first, a dedicated graphics workstation, was for ages the only way of getting the necessary quality and speed for tasks like rendering and texture-mapping. More recently, lower-cost software options – particularly *3D Studio* on the PC, from Californian software house Autodesk – have been used to create graphics that would previously have been solely in the domain of Silicon Graphics stations.

Release 3 of *3D Studio* gives Gouraud, Phong and Metal rendering, and the quality is certainly on a par with facilities you get on most Silicon Graphics systems. And while it is slower than dedicated hardware, the difference in speed isn't such a factor anymore, either – with 66MHz PCs available for £1,500, and with *3D Studio*'s ability to use multiple PCs as 'slaves' for complex rendering operations.

The '3D Studio look' has now become a recognisable feature of many games, with teams like Mirage (*Rise Of The Robots*), Trilobyte (*The 7th Guest*) and Bullfrog (*Magic Carpet, Theme Park*) relying on the versatility of the package to create the high-quality images in their games. And with the expansive memory afforded CD, *3D Studio* offers an affordable way of producing FMV without sets and actors.

You've only got to spend a few hours using this package to realise its power. Facilities like the materials editor, which gives you full control over the texture and light-shading of each individual surface, and the 3D Editor which allows you to apply the textures to the objects in your particular view.

But perhaps its most attractive feature is that a full *3D Studio* setup will cost only around £2,000 – including a powerful PC.

SiliconGraphics®

The Silicon Graphics option will cost you about £20,000 to get up and running properly. So while it's not the cheap option, the quality, performance and heritage of this hardware is beyond question. The actual systems themselves come in strange coloured boxes, with obscure names, like Iris, Indigo, Crimson and Onyx. You can tell this is classy kit at a glance.

SGI equipment is also synonymous with top design houses and movie special effects creators – George Lucas' Industrial Light and Magic (ILM) studios in California use no less than $15 million worth of networked Silicon Graphics terminals, for example. And films like Jurassic Park, The Abyss, Total Recall, and Terminator 2 would never have got off the drawing board without SGI hardware.

Software packages like *Alias*, *SoftImage* and *WaveFront* are the most commonly used programs on Silicon Graphics workstations in the videogames industry, and with the new SGI Indy out at under £5,000, Silicon Graphics hardware certainly isn't totally out of the reach of the masses.

Silicon Graphics (the company) makes dedicated graphics workstations – this means that much of the power has been built into the systems' hardware. At the heart of every SGI station are the ASICs (application specific integrated circuits), the so-called 'geometry engine' of the system, and the proprietary SGI chip, which was designed by MIPS – a US company that SGI bought in 1992. The ASICs and the Graphics Library are built into the high-end SGI stations, while the Indy and the cheaper Indigo systems just use the MIPS chip. But the Indy can still process graphics at an impressive 85 million instructions a second (Mips).

Developers using Silicon Graphics

Crystal Dynamics (*Crash 'n Burn, Total Eclipse*)
Dynamix (*Stellar 7*)
Infogrames (*Chaos Control*)
Nintendo (Project Reality)
Ocean (New, as yet unnamed CD titles)
Psygnosis (*Microcosm, Scavenger 4*)
Sega (*Virtua Racing* coin-op, *Jurassic Park*)
Sierra On-Line (*Outpost*)
Spectrum Holobyte (*Star Trek: TNG*)

Developers using *3D Studio*

Argonaut (*Creature Shock, Primeval*)
Bullfrog (*Theme Park, Magic Carpet, Creation*)
Cryo (*Saurus, Dragontales*)
Mirage (*Rise Of The Robots*)
Trilobyte (*The 7th Guest, 11th Hour*)

'SG has some attractive and powerful software, such as the *Alias* range, and the interface is far more intuitive to use on those packages than it is on *3D Studio*. However, it would take someone over two months of training to come up with a decent looking object, where in *3D Studio* that time is cut down to 2 weeks.'
Sean Griffiths, Main programmer, *Rise Of The Robots*

'I've had a look at Silicon Graphics and the gap between some of its packages and *3D Studio* is getting smaller. People go on about the kind of effects that Silicon Graphics can do, but with the new *3D Studio*, it can be done just as easily. The only real difference is the speed, but if it was me and I had enough money to buy an SG, I'd buy 10 PCs and link the lot in a network all using *3D Studio* – so instead of having one person working on one SG, I could have 10 animators working on *3D Studio* all together. The other benefit is that they could all render objects in a network. So, instead of one machine taking 50 hours to render a scene, with two machines, that time is halved, and so on...'
Marcus Morgan, freelance graphic artist (Creator of 3D Sonic image, p38)



FMV

Full Motion Video

Full-motion video gives you games and movies on 5inch CDs, and it looks likely to be the future of *all* video-based entertainment. **Edge** takes a look at the FMV story so far



If there is one set of initials that is set to become the centre of a new industry, it is FMV. FMV stands for Full Motion Video, and it's basically just what the rest of the world calls video – but every new era must have its own jargon to differentiate it from the past.

So what's it all about? FMV is the outcome of digitally encoding video – a technique referred to as MPEG encoding. MPEG is the

Continued next page

featureview: FMV

FMV in games

Edge asked several leading figures in the games industry what they thought of the standard of current full-motion videogames, and what the future could hold for this technology...

Eric Matthews
Director, Bitmap Brothers

'There are big problems with FMV, the main one being that you can't do much interacting with it.

'Games are interactive, that's the whole point, and if you're limited to a handful of options that reveal a few FMV sequences, the appeal wears off pretty quickly.

'Used sparingly and cleverly, however, it can add to a game. If you look at something like *Rebel Assault*, I think there





LucasArts' *Rebel Assault*: 'FMV has added to the whole experience...'

FMV really has added to the whole experience. In other cases it's been used simply as a replacement for gameplay – mainly by American developers.

'I think it will continue to be used and some people will carry on using it quite well in games, but I think generally that more exciting stuff is being done by developers using rendered images and staying true to gameplay.'

The MPEG encoding process

So what do you have to do to convert video into an MPEG signal?

1. The Master
The starting point is the master of the video. The tape will be on Beta SP or D1, the common video formats used in the professional market.

2. Digital conversion
The video is fed into an AVID – a standard industry box for analogue to digital conversion.

MPEG encoding is now a real-time process on the fastest machines...

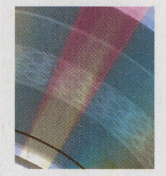
3. MPEG encoding
The digital datastream is linked to the MPEG encoder – which is now a real-time process on the fastest machines, but can easily take up to 200 times longer on slower systems. The operator begins the conversion by setting the encoding parameters. These settings specify the frequency of creating the Intra frames, the Predicted frames, and the Bi-directional Interpolated frames.

The MPEG encoding happens in a single pass, and the footage is scanned automatically. At the start of the first scene there is not any kind of reference point for the image, so the entire frame is encoded. The main data frames are known as the Intraframes, and they take up around 150K each.

The encoding process effectively takes frames in blocks of four. Starting with either an I-frame or a Predicted frame (P-frame). Frame 1 is scanned, then frame 4. The computer compares the difference between the two and stores this information as motion vectors.

If all the differences between the two frames were to be analysed it would take some three million floating point operations

Continued



abbreviation for the Motion Pictures Expert Group, an international body whose job it is to set a standard for the capture and playback of digitally encoded film or video.

It sounds simple enough, but then why should anyone bother? Why would anyone need to encode video signals as a digital track on a CD? Well the plan with MPEG is to revolutionise the way film footage is used and delivered. The market is now aware of the advantages of digital sound, but the use of digital video is still in its infancy.

Today's video recorders send pictures to the screen at around 200 lines per frame – well down from the 625 lines we are used to with TV pictures. Super VHS is an improvement, but the future, probably three years away, is High Definition TV (HDTV), and very high quality digital video.

Today's MPEG is little better than Super VHS quality but all the technology needed to increase the quality is in development or available today. Ultimately HDTV with MPEG compressed digital audio could be the future of all visual and audio entertainment systems.

So how does MPEG encoding work? Well, VHS signals are relatively simple to emulate,



The MPEG version of *Mad Dog McCree* for CD-i is higher quality than the non-MPEGed 3DO game

having a low image resolution and slow data rate. But without any kind of compression you would only get around 20 seconds of video signals onto a CD. And even the most avid of digital audio/visual enthusiasts agree that it might get a bit tedious changing CDs every twenty seconds.

So, in steps MPEG compression, a standardised system that uses hardware to squash about 74 minutes of video signals onto a single CD. And that means changing CDs only once during the average feature film – not such a bad thing to put up with really.

Another solution to compressing video is a system called JPEG. JPEG is now fairly well established as the format for handling still pictures, and some systems are available for







Virgin's graphic masterwork *The 7th Guest* on the CD-i – its smoothest and finest incarnation yet. The data for each graphic sequence in the game was re-encoded using MPEG for the CD-i's Digital Video cartridge

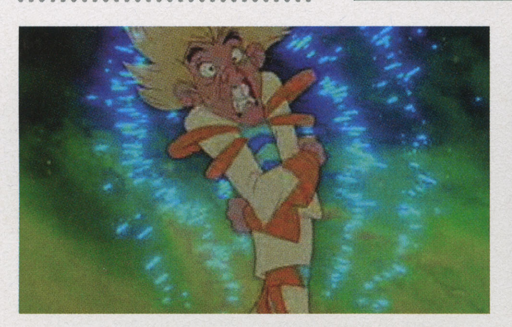
per second (flops) of computing power – which is serious processing. To avoid this, algorithms have been developed to simplify the process, and it's these software routines which have led to the development of today's real-time encoding systems.

The other essential tool of the encoding process, the P-frame, contains the information about movements onscreen and the colours used in each scene. All of this gives files of around 50Kb each. If just these routines were used throughout the video it would be possible to playback the film, but a film encoded to this level would appear jerky, and you would know that something had been done to it.

The final stage is to create the Bi-directional Interpolated frames ➔



The Philips CD-i Digital Video cartridge – in spite of the DV branding, this is another MPEG standard system, capable of playing Video-CDs





Two different approaches to FMV in games: *Space Ace* on the CD-i (left) is a *Dragon's Lair*-type interactive cartoon, while *The Journeyman Project* (right) for PC and Mac is a high-quality point and click adventure

running a connected series of JPEG images as video. But this isn't a practical solution for extended video, as all the information from each frame has to be stored – again this means you limit the amount of running time on a disc.

So the best systems so far are the two MPEG standards – MPEG 1 and MPEG 2. Perhaps the most commonly asked question is, what is the difference between between MPEG 1 and 2? Well, they both work in a similar way, and they both offer similar viewing qualities when used to playback information at low data rates. But the quality of MPEG 1 decompression starts to tail away when it has to deliver above 3Mbits/sec (that's 384K of information a second). MPEG 2 on the other hand, uses a better compression method and can deliver a massive 15Mbits of data per second.

MPEG II compression can deliver a massive 15Mbits of data every second...

Because of its limitations, the use of MPEG 1 compression is being targeted mainly at improving CD data transfer rates. Because of its speed, MPEG 2 compression is designed for higher data rates, and for the broadcasting of digital video.

From the announcements made by a host of manufacturers it now seems clear that MPEG 1 and 2 will become the standards for both broadcasting and playing back video on a wide variety of platforms from CD-ROMs to TVs.

And most of the new CD-based systems now available or announced, such as CD-i, CD32 and 3DO will offer MPEG playback options.

The technology is really just in its infancy and the feeling among the encoding community is that the process will become simpler and will produce better results as experience increases. It is hoped that libraries of techniques will be developed to help speed up the process of encoding MPEG signals.

The market leader in this technology is C-Cube and its UK representatives Kudos

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Robbie Henderson
Creative Director, Storm

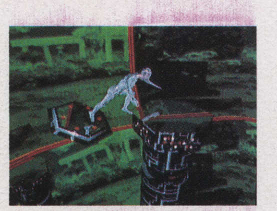
'What we've seen of FMV so far is most definitely just the tip of the iceberg. I would accept that some of the first generation of products to use the technology have been a bit flat – but what do you expect?

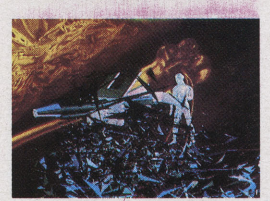
'We're on a very steep learning curve at the moment and, in our case, *Lawnmower Man 2* will be a huge step forward from *Lawnmower Man*.

'It's also worth bearing in mind that economics demand that we aim at rather low-end machines.

'Next time we'll be aiming at 486s with double-speed drives, loads of Ram, etc. I think that's why the poor quality, flickering images that we've seen so far aren't really a problem. And more and more games systems are conforming to MPEG, and so better than VHS quality is easily achievable.

'I believe that soon there will be total FMV products with no rendered imagery. Games that offer somewhere between 100 and 1,000 different options and can be played through in around an hour.'





Storm's *Lawnmower Man*: 'What we've seen so far is just the tip of the iceberg'

featureview: FMV

Steve Clarke
New Media Manager, Virgin

'There is an upside and a downside to FMV at the moment. Firstly, FMV is extremely useful in that it is something people recognise and are familiar with. The flip side of that is the problem in combining something linear into a product that has to be interactive. That's a situation that will take time to resolve.

'Early products have been slagged off for their lack of interactivity, but you have to remember that it's very early in the development of what is a new discipline.

'The problem with the quality of image isn't a longterm one – it will be solved with the next generation of hardware.





Virgin's *Demolition Man*: 'Incorporating film into games will take time...'

It's the problem of incorporating film into games seamlessly that will take time.

'I do still see a very big future for FMV as closer and closer links are established with studios and directors and technologies converge.

'The key is good design so that the inevitably linear nature of some FMV doesn't stop and start the gaming experience.'

← (B-frames) which fill up the space between the I and P frames. Again the encoder does this for you: the system has encoded the first and fourth frames. It then goes back and sees how many frames it has missed and divides the movement differences it has detected in frame four by the number of missing frames.

If frame four had an arm that moved up 0.25m from frame one, the system would calculate the exact amount of movement, which would be around 0.08m per frame. Then it works out where the arm would be in frames two and three, and stores that information along with any other positional change information as B-frames. Not surprisingly these files are the smallest of the lot, averaging around 20K each.

MPEG encoding works to a compression factor of 200:1

As far as the system is concerned it stores and plays back the frame sequence in the following order: 1,4,2,3 then 4,7,5,6. It has to do this because it takes the first frame to see where it is, the last to see where it should be, and it generates frames 2 and 3 on the fly.

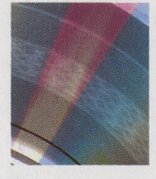
Although it takes frames in blocks of four it has to keep the last frame of the previous block in order to have a reference point for the next P-frame.

4. Final compression

To achieve full compression without losing picture quality, MPEG uses a second process. To understand how it works it is important to grasp how basic video data is stored.

In standard video each frame is made up of two fields, odd and even, with the odd field having the information for lines 1,3,5,7 etc while the even field carries lines 2,4,6,8 etc. PAL TVs work at 50Hz, so you have 50 fields – which equates to 25 frames. NTSC runs at 60Hz so has 60 fields, and therefore shows 30 frames per second.

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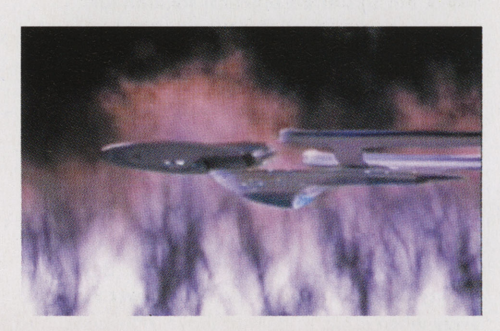
Thame. C-Cube developed and patented many of the fundamental routines for searching strategies and measuring the movement changes between frames of video. And it's the techniques for working out the movement between frames that are the key to storing MPEG video.

If you invest in an MPEG playback systems, you'll almost certainly find that the main decompression chip is the C-Cube CL450, which has become the standard item in the industry. It is currently used in Amiga's CD32 FMV cartridge, and a reworked version sits on the ReelMagic board – the first low-cost MPEG playback board for the PC. Philips were originally developing their CD-i FMV cartridge with C-Cube, but they switched horses halfway through, and their Digital Video cartridge – now finally in the shops – uses the Motorola MCD250 chipset.

Having gone to the effort to produce an MPEG disc, what can be done with it? Those in the know have identified four areas of expected growth for MPEG; interactive videogames, consumer broadcast, general computing, and video conferencing.

Each market segment will produce new products to make best use of the technology. It is at this point that the benefit of having MPEG as a standard is clear. With the number of consumer based machines already standing at three (CD-i, CD32 and 3DO), and with another four known to be in the pipeline (Jaguar, Nintendo/SGI, Sega Saturn and Sony), the consumer will have to start making decisions: whether to invest in any of these systems, or to wait until the war is over and go with the winners who emerge from it.

There won't be enough market share to support all these formats, but by having a basic standard in MPEG and Video-CD – which is just a simple way of describing an MPEG stream – prospective purchasers of the systems can be confident that if they back the wrong horse, at







MPEG finds it difficult to cope with busy scenes, resulting in blockiness and 'heathaze' artifacts, as in this shot from Black Rain (bottom right). Careful encoding is better than VHS quality: Star Trek VI (top right)

As part of the MPEG process, a field is dropped and every other pixel is discarded from the remaining field by a process called decimation. This results in 75% of all the original information being removed, so the overall compression can be multiplied by four to get a higher total compression ratio.

MPEG encoding works to a compression factor of 200:1. This is 50:1 compression with four times decimation.

The greatest difference between MPEG 1 and 2 is that MPEG 2 does not cut out this additional data, and it compresses to a higher ratio than MPEG 1. Therefore you have four times the amount of information contained in an MPEG 2 frame, resulting in far greater clarity and sharpness →



The Full Motion Video cartridge for the Amiga CD32 gives MPEG 1 compatibilty, allowing you to play Video-CDs as well as CD32 games





Movies on Digital Video boast variable slow motion in forward and reverse, plus perfect freeze frame (left). A contents list enables you to jump to any 'chapter' in the film – on that particular disc, of course (right)

least some of the software will be compatible across the formats. Any film collection will be usable on all these systems – assuming Nintendo includes a Video-CD feature and a CD drive with its much touted Project Reality system.

The first applications are already with us now. CD-i digital video is here, the CD32 cartridge is slated for release. ReelMagic is shipping now for PC, and 3DO will no doubt have its version of the technology out by the end of the first quarter of 1994.

By 1995 the experts reckon the market for consumer FMV products will be worth over $130m. And by then it is likely that the first real-time encoding boxes will be around. Encoding until recently has been at between 20 to 200 times real-time. This means that a single frame can be converted in around 1 to 10 seconds. But the first cost-effective real-time systems are now arriving. Again C-Cube is leading the market with the CL4000 – a snip at just £70,000.

By 1995 the market for consumer FMV products will be worth over $130m

Silicon Graphics and IBM also have real-time encoding systems but they cost even more. Still, it's not going to stay that expensive. C-Cube should have a plug-in card in the £1,000 region, giving real-time encoding and playback, within three years. There will also be consumer boxes offering recording and rewritable discs.

By this time you will be looking at FMV as the replacement to VCR. The main advantages to the consumer will be a higher picture quality, instant access to any point in the disc, perfect freeze frame and less picture breakup as the disc gets old. But most importantly, it will provide the potential for full interactivity.

Welcome to the age of FMV.

Phil Harrison

Product Development Director, Sony Electronic Publishing

'I think that what we've seen of FMV in gaming so far could be fairly described as gimmicky.

'And in most cases the production values are so desperately low. We need to allocate substantial budgets, and use professional film-makers, not send out spotty programmers with a camcorder to film the receptionist and her brother-in-law.

'Once that happens and the next generation of hardware allows the use of true broadcast-quality footage, FMV will begin to play a very big part in interactive entertainment.

'I believe that FMV will just become an accepted feature of gaming, like scrolling is now.





***Dracula*: 'FMV will be less obvious, rather than this awful stop/start element'**

'If games are designed properly, FMV will also become less obvious, it will be woven into a game rather than be this awful stop/start element. The distinction between passive video sequences and interactive rendered sequences will be fuzzy.

'Fully interactive movies, however, are just pipe-dreams at the moment.'

Continued next page

← of the decompressed image.

5. Encoding settings

On a good quality encoding you would typically set the distance between I-frames to 15, and the number of B-frames to 1 or 2. This means that every fourth frame will be a P-frame. In a half second of film running at 25 frames per second you would have one I-frame, four P-frames and eight B-frames.

The video running sequence would look like this: I-BB-P-BB-P-BB-P-BB-P-B-I. But the actual encoding and playback order would be 1,4,2,3-4,7,5,6-7,10,8,9-10,13,11,12-13,16,14,15. The C-Cube encoding chip has the ability to drop extraneous frames during encoding and would probably drop frame 16 from the first pass so as not to include it twice.

6. Error correction

What happens if a scene change happens during a B- or P-frame, or if an I-frame doesn't represent a major scene change?

The answer is that the algorithms contain tripovers so if more than a permitted amount of change is detected, the system can store I-frame data within a B- or P-frame to ensure a continuity of display.

The encoding algorithm allows for up to a third of a frame changing from the preceding one. But with a major scene shift, the system cannot stop, so it adds as much of the information in the new frame as it can. As it can only change a third of the frame, you get an overlap between the two frames, and the viewer sees 'artifacts' – these are the blocks of misplaced colour carried over from a previous frame.

High-end production houses re-edit the finished data frame by frame...

As the system changes a third of the information per frame it will take three frames to be fully corrected and for the true picture to be restored.

7. Quality control

It is at this point that you can start to appreciate the difference between high and low quality MPEG encoding. Various low-cost MPEG encoding solutions are available on the market, but these generally offer poor quality playback as they are not able to create B-frames.

You might think that this is not a problem, as by increasing the number of P-frames you could create a good likeness of the image for playback. But the eye is sufficiently sensitive so that the finished footage looks jerky and unrealistic.

At the other end of the quality spectrum, high-end production houses might go through the film frame by frame to mark major data changes and to specify that

Continued

MPEG

the new **four** letter word



MPEG, the Moving Picture Experts Group, is a spin-off from another standards committee, JPEG, the Joint Photographic Experts Group, which is concerned with still pictures.

Don't be fooled: these standards do matter. When standards are tight, as they are for the plug-and-go Sega, Nintendo and CD-i system worlds, no-one has to worry about whether software and hardware, bought from different vendors, works together. It always does.

When standards are loose, as in the crazy world of the IBM PC and CD-ROM 'compatibility', half the fun of playing a new game is in getting it to run at all.

This all started with JPEG, so let's try and get a handle on what exactly that is. Still picture graphics soak up a lot of disc and memory space in a computer. JPEG sets a standard for compressing the data, so that it takes up less space.

The coder maps every point of the picture, and looks for redundancy, eg areas where this no detail, just a wash of sky or cloud. A technology called Discrete Cosine Transform improves efficiency by dividing the image into many square blocks, and coding each one separately, while looking for.similarities between adjacent blocks.

This reduces the number of digital bits needed to store a reasonably accurate representation of a still picture by a factor of up to 10:1.

But this all changes totally when you're dealing with moving images.

Movie film captures 24 full frame pictures a second. European PAL video captures 25 and the NTSC system used in the US and Japan shoots for 30 (but with less scanning lines in each). To avoid visible flicker onscreen, each frame is broken down into two halves, or 'fields', each containing half the total picture lines. The lines are odd in one field, even the next, then odd in the next again, and so on. Onscreen the two fields 'interlace' to give the illusion of full pictures displayed at a 50 Hz (or 60 Hz).

The JPEG system is often used to digitise moving video, but the data rate is far too high to store on a CD, which has a maximum capacity of under 150K/second.

But this is where MPEG steps in to save the day. Five years ago RCA's Research Centre in Princeton, New Jersey showed that it is possible to squeeze full-motion video into the 150K/second space on CD. This could be done, they explained, by comparing the content of each picture with the content of other pictures in a moving sequence, and coding only the differences between the two.

Five years ago it took a mini-computer several minutes to encode one second of full-motion video. Now decoding can be done in real-time, either by software or (with far better results) by



The Philips Research Laboratories in Redhill, Surrey. This facility is where all of Philips' movie and game MPEG encoding takes place



Philips' ***The Worlds Of...*** **is the first interactive FMV music CD**

the system encodes these fully. Or they can go back through the film after encoding and re-edit the finished data frame by frame.

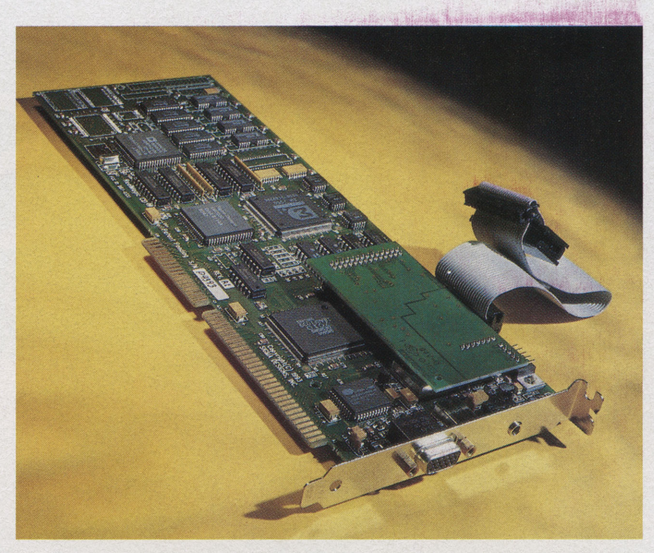
8 Final touches

After encoding, the video stream is reduced to around 120Kb/second. This is then interleaved with the audio, which takes around 20Kb/second, and control information takes the rest of the bandwidth to take you to 150Kb/second – the data transfer rate single speed CD-ROM drives work to.

So what can we expect of the finished products? Philips has now released its first CD-i films – which have all rightly been praised for the quality of the encoding.

Three factors helped here. First, they were working from film as opposed to video. Secondly, the conversion was carried out by Valkieser, a top Dutch post production house which uses Silicon Graphics' Onyx workstations to carry out the encoding – these produce very high quality finished code.

Thirdly, a great deal of post-encoding editing was performed to remove artifacts and improve the quality.



The ReelMagic board gives PCs the facility to playback MPEG 1 CDs. Like the CD32, it is powered by a version of the C-Cube CL450 chip

hardware, ie microchips.

The industry is close to real-time encoding in chips, too, and the potentials of this are incredible – CD-ROM camcorders, for example. The chips are already available, but are prohibitively expensive.

MPEG held its first meeting in Ottawa, Canada in May 1988, but the standard for MPEG 1 wasn't set until November 1992. It took four years of haggling to set this standard, with several interested parties (primarily Philips) concerned about maintaining their competitive edge in the standards world.

The MPEG committee is now working on a second standard, MPEG 2, which deals with the higher data rates needed for broadcast quality TV transmission and video recording.

There is no MPEG 3, because its work was absorbed into the MPEG 2 group. But in the second half of the decade there will be an MPEG 4 standard, for very low bit rates (only tens of kilobits per second).

Today, the videogame and PC market is only concerned with MPEG 1; in future it will explore the potential of MPEG 4, probably for use in videophones.

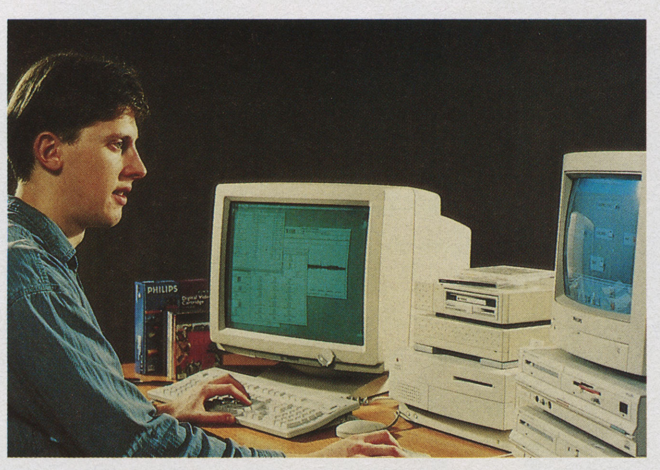
There is a popular notion that adoption of the MPEG 2 standard will improve picture quality *and* stretch playing time so that one single-sided disc can hold a full length movie.

MPEG 2 will indeed offer higher picture quality than MPEG 1. But this requires a doubling of data rate to 300K/sec, which is currently only achievable by doubling the speed of the disc player. And this halves playing time, from 74 minutes to a paltry 37 minutes.

To provide 148 minutes of MPEG 2 at 300K/sec on a standard-size CD requires a quad-density recording (four times standard speed), with quarter size data pits. And this will require completely new laser optics in the player, to focus on the smaller pits. It also breaks the CD standard, something which Philips the standards gatekeeper has always vetoed.

But who knows? In six months maybe the slowcoach 150K/sec CD-i player will be in the technology trashcan – possibly even along with the 300K/sec 3DO Multiplayer, which is already looking tame.

And by then perhaps we'll all be playing our movies and games on the quad-density Sony PlayStation?



DV discs are formatted using Philip's own *Toolworks* software running on Mac Quadras. The MPEG encoded footage is stored on optical drives



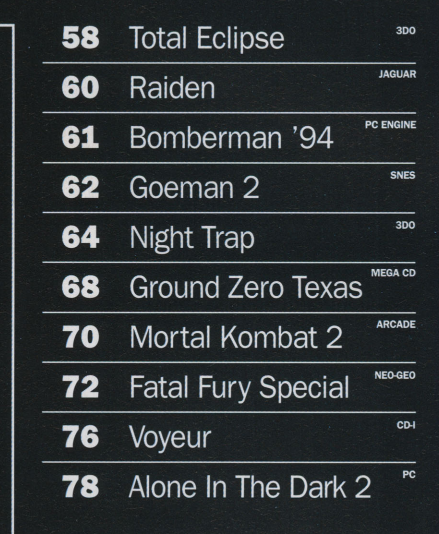




Games machines or movie players? The first three MPEG-capable machines, (from top) CD32, CD-i and Panasonic's 3DO player

Total Eclipse Raiden **Bomberman '94** Goeman The Warrior 2 **Night Trap** Ground Zero Texas **Mortal Kombat 2** Fatal Fury Special **Voyeur** Alone In The Dark 2

Testscreen



With the minor interruptions of Christmas and the Las Vegas CES, this issue of **Edge** really went to the wire – and slightly past it, in fact.

However, this meant that we just had time to squeeze in the world's first review of *Total Eclipse* on 3DO. At last, Crystal Dynamics' have shown what the 3DO can *really* do...

Likewise, *Night Trap* on 3DO may not be particularly playable, but the quality of the video footage really puts the Mega CD version in the shade.

And if you thought *Night Trap* was violent, wait until you get a load of *Mortal Kombat 2* – the coin-op sequel from Midway. The 'death moves' which the original unleashed upon an unsuspecting public have been improved and intensified, resulting in some surprisingly gruesome scenes.

And while **Edge** cannot condone such crass exploitation of gratuitous violence, it is a great laugh.

58

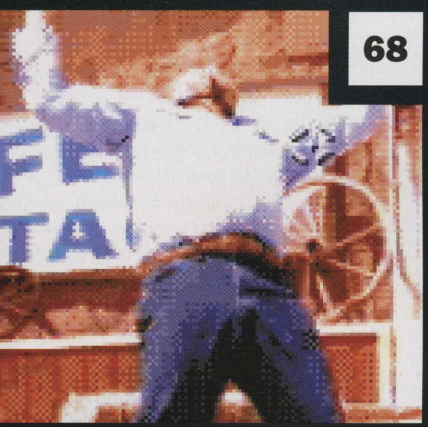


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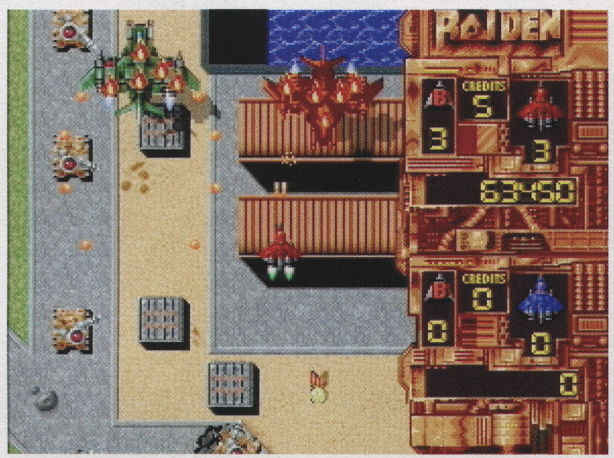
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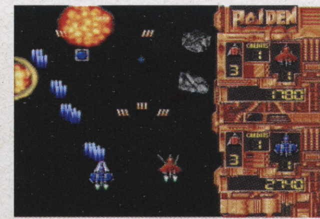


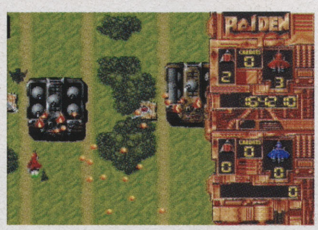


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Raiden







There's not really very much to say about *Raiden*: Imagitec have made the best of a bad job. The one highlight – for twin joypad-owning gamers – is the co-operative two-player mode (top right) which is fun

Format:	Jaguar
Publisher:	Atari
Developer:	Imagitec Design
Price:	£50 (import)
Size:	16Mbit
Release:	Out now (US)

In a move typical of the company, Atari have taken one big step forward with the 64bit Jaguar hardware – and two steps back in their choice of software. Following in the crusty footprints of the abominable *Crescent Galaxy*, *Raiden* does absolutely nothing for the Jaguar cause.

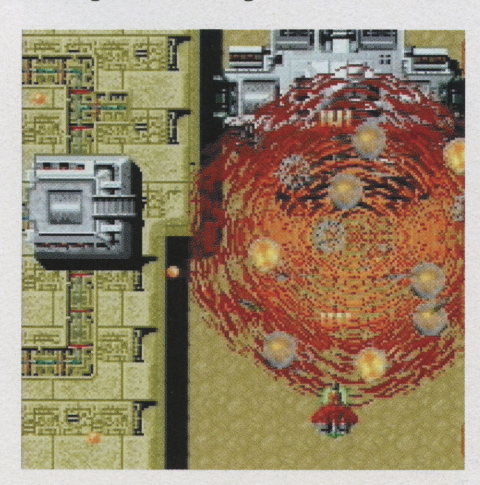
Based on a four-year-old arcade game, Raiden is an *adequate* vertical scrolling shoot 'em up. It's very busy – unfairly so at times – but apart from a reasonable smartbomb effect and some obligatory (if sparse) parallax scrolling, there's nothing here that hasn't been done – in one way or another – on lesser machines. The graphics are two-dimensional and many a Commodore 64 owner would sneer at the supposed 'CD quality' music.

So it's probably arcade perfect... so what? The original was far from state-of-the-art when it was released, and the move from coin-op to console has done it no real favours. Coin-ops are profit centres designed for a quick turnover. As such, *Raiden* is a tough game; but rather than add difficulty levels, you can choose from three, five or eight credits – the latter giving a total of 40 lives! Reaching the last level – if not finishing the entire game – can easily be achieved on the first day.

Once your ship is heavily tooled-up, the action is quite enjoyable – but that enjoyment is shortlived. With frustrating inevitability, it's only moments before a stray bullet or particularly devious enemy robs you of all your hard-won hardware.

With such poor game structure and lack of finesse, Atari would have been better getting Imagitec to write an original shoot 'em up, rather than spending money on such a non-eventful licence. It's not that *Raiden* is a bad game; just the *wrong* game.

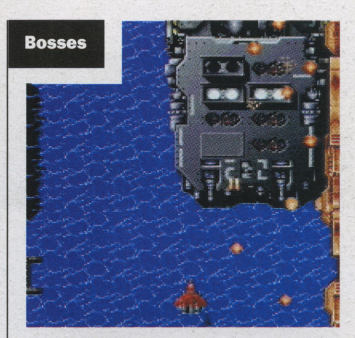
With titles like *Aliens Vs Predator*, *Mortal Kombat* and *Doom* on the way, Jaguar owners would be well advised to grit their teeth and be patient just a while longer.



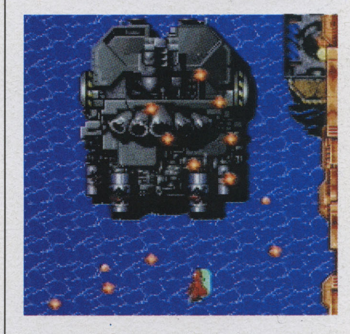
Raiden's trademark is this smartbomb explosion. Still not overly impressive for the Jaguar, though

Edge rating: **Five**/10

Bosses







Bosses require multiple hits and copious smartbombing to destroy them. Successive hits gradually chip away at their armour (top to bottom)

Total Eclipse

Format:	3DO
Publisher:	Crystal Dynamics
Developer:	In-house
Price:	£55 (import)
Size:	1 CD
Release:	Out now (US)

After a slight delay, the game all 3DO owners have been waiting for finally arrives. *Total Eclipse* is the second offering from Crystal Dynamics – *Crash 'n Burn* being their first – and once again, the California-based company have shown other developers how to really use 3DO's hardware.

Graphically – in case these screenshots haven't convinced you – *Total Eclipse* is way ahead of anything seen on any home machine currently available. The rendered spacecraft looks great and the lightsource shading is impressive, but it's the texture-mapped planet surfaces that you'll find quite simply astonishing. They move so smoothly, and at such speed and with so much detail, that you'll walk away from your 3DO system utterly convinced you're finally entering the next generation of videogames.

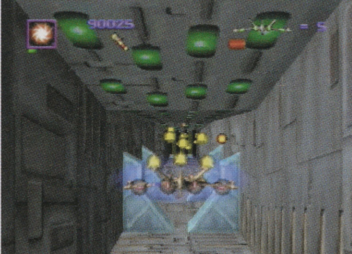
The craft you control – the FireWing fighter – is highly manoeuvrable and capable of some really impressive stuff. You can perform barrel rolls, but unlike *StarFox*, your craft doesn't rotate while the screen stays put. When you perform a barrel roll in *Total Eclipse* the entire screen rotates – planet and all – around your FireWing, creating a truly arcade-like experience. And unlike *Crash 'n Burn*, all



The wonderful visuals do their best to hide a fairly standard shoot 'em up. Everything in *Total Eclipse* moves in 3D – except, strangely, for the bosses. This scorpion-like craft scales smoothly towards and away from the FireWing, but never fully rotates or spins around. What a swizz...









The hardest sections in *Total Eclipse* are found beneath the surface of the planets. Flying through these tunnels is a sight to behold, but avoiding hitting the sides is an entirely different matter

The weapons

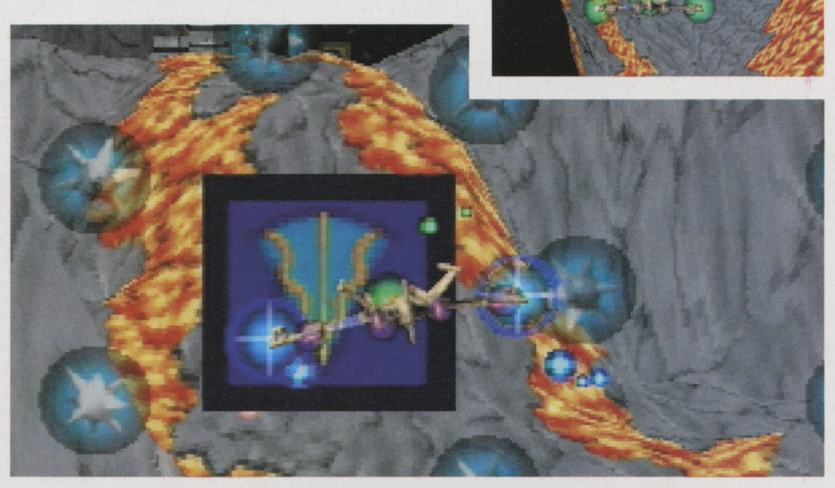
Weapons can be found floating above the planet surfaces, and to pick them up all you have to do is fly into them. There are six weapons you can arm your FireWing with. These are:
The **Stellar Ground Blaster**. This is your stock weapon and shoots only in a forward direction.
A **Scatter Gun**, which launches a spray of bullets in all directions.
The **Photon Strafer** fires in three directions, both to the ground and into the air.
The **Ion Whipgun** spreads deadly projectiles out at Mach 5.
The **Rotary Gun** fires bullets in all eight directions.
And the **Plasma Bomb** damages everything in sight, acting like a smartbomb.
Each weapon can be powered up to a maximum of three times the power of the standard weapon.

these brilliant visual effects are not being pulled of the CD: everything is being drawn and calculated in real-time, on the fly. In fact, the only thing being pulled off the CD this time is the irritating rock music – somehow the ingame tunes don't manage to suit the game as well as they could have.

Enough of the aesthetics, what about the actual game itself? One of the biggest worries most people had when they first heard about *Total Eclipse* was how much freedom the game would give the player. Would you be able to interact with the background and fly in between those gloriously detailed mountains? Well, although you're not given the freedom to fly wherever you want – you can't turn around – you can fly within a fairly wide perimeter.

Total Eclipse has been cleverly structured to give the player the 'feeling' that they can fly wherever they want: into and out of canyons, over mountains and through hills – but ultimately you're limited to one of two or three routes. Impassable mountains – the ones that border both sides of the play area – are also used to create 'paths' which you must take during a level. Okay, so you can choose which path you'd like to go down, and during some levels you can even change from one path to another, but you still feel a little restricted.

Total Eclipse is made up of 20 levels which are basically split into two sections. The first takes place on the planet surface, and the second in serpentine-like tunnels that run underneath the planet surface. Here, in typical *Star Wars* style, you have to fly under and over many obstacles – while shooting at the enemy. Luckily, you do have a degree of control over how fast you go. And through these narrow,



One of six available power ups (above). The 3DO shows off its graphical prowess as the FireWing spins to avoid a mountain. The whole screen rotates around the craft (above right)

Continued next page



When you approach the end of any section, a large mountain face blocks your path (left). The only way to get to the next section is to fly the FireWing into the tunnel tractor beam. You'll then enter this tunnel section (above). The texture-mapped polygons are truly awesome, and it's hard to believe that this much detail running at this speed is possible on any home system

Continued

curling and twisty tunnels, it's essential that you go slowly as it's very easy to hit the sides.

Which brings us to the next problem – collision detection. No matter how good a gamesplayer you claim to be, there's no way you're going to get through any of these tunnel sections without colliding several times with the walls or obstacles. This is a problem that could so easily have been avoided: all your ship needs is some kind of shadow, so you'd know where you are in relation to objects around you. It's something the programmers did in the outside sections – a map helps you here – but neglected for the tunnel ones. The end result is a very unplayable section.

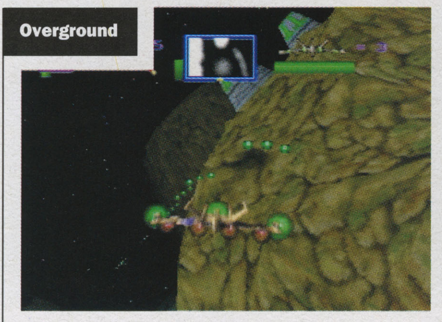
Any good shoot 'em up needs power ups, and *Total Eclipse* has them – only they're not very effective. It's mainly due to the 3D perspective, but no matter how tooled up your FireWing is, hitting the enemy is always very difficult. You do get better with practice, but there are times when you can be shooting literally hundreds of bullets towards the enemy, only to see them all miss.

It's hard to criticise a game that looks and moves as well as this, but it's the way it plays, as well as the way it looks that matters. At the end of the day you don't feel like you really 'have' to play *Total Eclipse*, instead you feel more compelled to have a session with it.

It's a definite move in the right direction for this system, and it further strengthens Crystal Dynamics as leaders in the 3DO market. But, as most of us are aware, this is no mean feat at the moment.

Edge rating: **Seven/**10

Overground



The FireWing strafes a gun turret. They're sitting ducks, but watch out for homing missiles

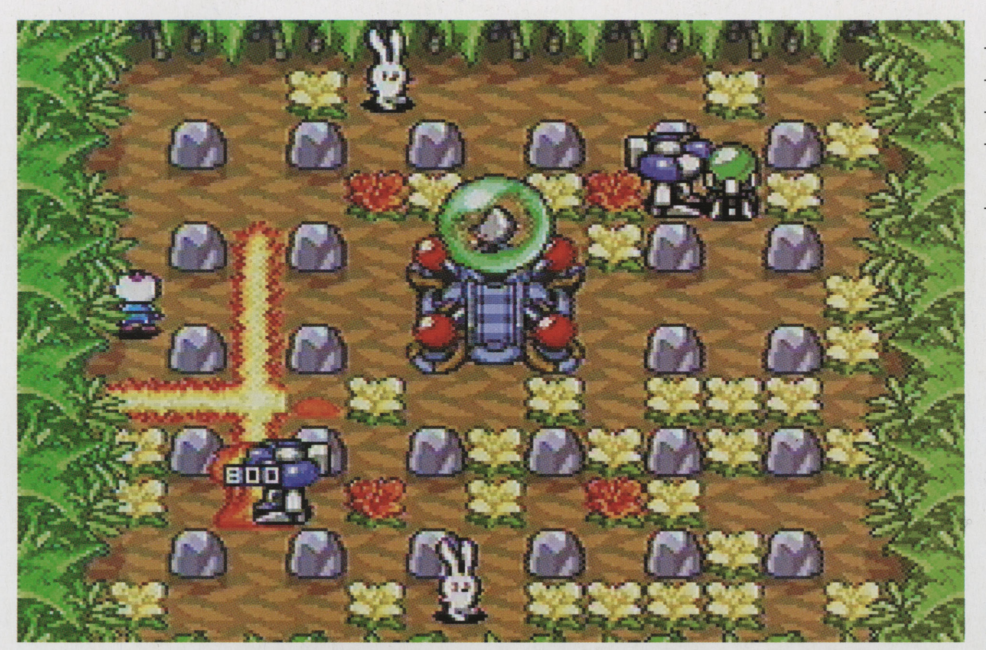


Everything in *Total Eclipse* looks gorgeous – even the explosions are a real sight to behold



Motion sickness guaranteed. Flying upside-down is fun but extremely disorientating

Bomberman '94



***Bomberman '94* is essentially the same game, but subtle differences make this the best version so far. This forest level is colourful, yet deviously structured: beware the cute bunnies...**

Format:	PC Engine
Publisher:	HudsonSoft
Developer:	In-house
Price:	£55
Size:	4Mbit HuCard
Release:	Out now (Jap import)

Long before SNES owners knew who *Bomberman* was, PC Engine owners had already enjoyed two outings with this explosive character. Indeed, *Bomberman* has a long and distinguished lineage.

Back in the mists of time a relatively unassuming coin-op called *Dynablaster* appeared and, in tune with the times, its gameplay premise couldn't have been simpler. Within the confines of an overhead view, single-screen maze you drop bombs. After a brief time, these explode in four directions either destroying anything within range, including you, or hitting an indestructible block. Naturally the point was to blow up various nasties which also inhabited the maze world. Destroy all the baddies and move on to a different, more densely populated, maze. And so on and so on.

After a successful Super Nintendo version, inevitably HudsonSoft thought it was time for a new PC Engine version – and here it is. Gameplay, thankfully, hasn't been tampered with much: after all that's what made the original games so endearing. But it's the subtle tweaks that have made the difference. The screen is slightly smaller in size and the resolution is higher and the graphics look sharper. More colour is used here than ever before and the whole thing just has a much more polished look to it.

There are now also a host of 'characters' to choose: their selection isn't as essential as it could have been, but choosing the child means you run faster than the others; and while the old man may move slower than the rest his kick, oddly, is more powerful.

The inclusion of eight new stages – the Polar stage being the best – and some rideable kangaroos complete the re-vamp. Incidentally, each kangaroo behaves in a different manner depending on its colour, so more experimentation is required in this version than ever before.

Any self-respecting *Bomberman* fan will love this: it looks and sounds great, it's got more levels and characters and there's still the irresistible urge to blow up your pals. What more could you want?

Edge rating: **Eight**/10

Supplied by: **Raven Games (081) 663 6822**







Ride the kangaroo (above) for extra help. A powerful bomb (middle) explodes. The trees (bottom) offer brilliant camouflage for your bombs

Ganbare Goemon 2

Format:	SNES
Publisher:	Konami
Developer:	In-house
Price:	£75
Size:	16Mbit
Release:	Out now (Jap)



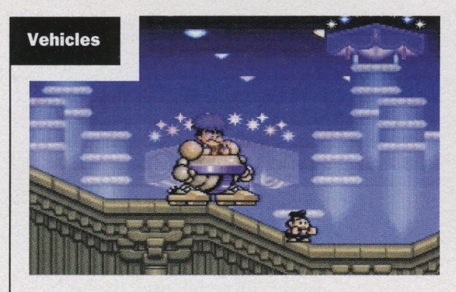
Supplied by: Raven Games (081) 663 6822

Variety is the spice of life. A simple, but devious platform section (above) and the bonus level (left) where you control a huge robotised version of yourself

SNES owners can rest easy – for the time being anyway. You might be thinking that what with all these high-powered game systems threatening to muscle their way in and 'take over' the world of videogames, comparatively underpowered machines like the Super Nintendo may soon become extinct. But, no matter how technically advanced a machine may be, it's the quality of its games that matter. It's like having a car that has the dynamic and purposeful looks of a Lamborghini Diablo, but the grunt of a dilapidated Mini – in other words, totally useless. And 'useless' is the word that best describes most of the games that have been released for these supposed next generation machines.

Amidst all the disappointment currently surrounding the software on 3DO, Jaguar, and to some extent CD32, Konami have released

Vehicles



The robot suit is useful for trampling on the enemy, but is cumbersome in its movement



This mouse offers a fast and effective way of getting through some of the levels



Luckily there are plenty of fish swimming around – jump on one to get across the water

In town



Games can be found in some of the houses (above). Useful weapons can be bought from some of the shops (above right). The townsfolk won't attack you, unless you get nasty (below right)

Action in *Goemon 2*

Unlike the first *Goemon*, this sequel is far more action-based. There are so many different types of game styles crammed into *Goemon 2* that it presents a constant and varied challenge. Like the first game, *Goemon 2* starts off quite slowly, but as you progress, you're gradually introduced to new gameplay aspects. There are vehicles to drive, robots to fight, puzzle games to play, bosses to defeat, platforms to negotiate – in fact, almost every game genre is included in this very polished package.

Those of you that liked the adventure side of the first game – the town sections – will be glad to hear that they're still here. There's still lots of hidden sub-games, weapons to buy and people to talk to, but they're less complex in their structure, and act more like a link to the next stage.

the follow up to their cult hit *Ganbare Goemon* on the SNES. And in the world of rendered images, non-interactive gameplay and glorified demos, *Ganbare Goemon 2* shines very brightly. In fact, it's quite simply one of the best examples of software **Edge** has seen on the SNES for quite some time.

The original *Goemon* was a strange mishmash of all sorts of games: it contained arcade platform sections, arcade adventuring sections and it also had loads of hidden sub-games. Some people criticised it for being too sprawling and open – you never really knew where you should be going or what you should be doing – but the same can't be said this.

Konami have taken all the best bits from the original, and simplified them. This time the town sections have been made easier to negotiate and less 'maze-like' in their structure. Interaction with the other characters isn't as essential as it was, and the town folk will only attack you if you attack them. There are still some hidden sub-games – a perfect copy of *Xexex* is hidden somewhere – only there are less of them. Instead, most of the game takes place on the vertically and horizontally scrolling platform levels.

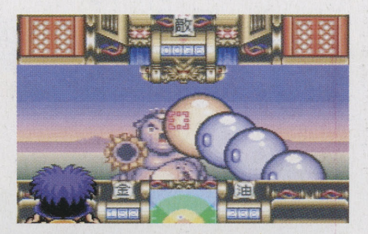
Konami have mixed together many different varieties of platform action, and because of this, *Goemon 2* always holds your interest. One minute you're jumping around a huge abacus in the sky, and the next you're travelling down a mountain – on top of a giant snowball. You never know what the game will throw at you next. Then there are the bosses, not your normal 'please sir, don't hit me' type bosses, but big Mode 7 scaling bosses. In fact, the bosses are so big, that your character – you have a choice of three – has to climb inside a 20 storey high robot to fight them.

Goemon 2 also has a great learning curve, you always seem to get a little further with each go, and there's a useful save game feature. Presentation is near CD quality, the clever in-between-the-level scenes tell the story perfectly, and the sound is simply astonishing.

Goemon 2 also contains something that a lot of software companies seem to have forgotten about – playability. Konami have made the play mechanics in *Goemon 2* just about perfect. You're given so much freedom to do what you want and the ability to go where you want: you even have the freedom to select which level you tackle.

Overall, *Goemon 2* blends brilliant graphics, great sound and near perfect playability into one explosive package. Something a lot of the more powerful machines are still attempting to do...

Edge rating: **Nine**/10

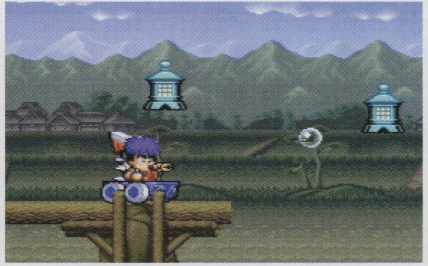




To fight the huge end-of-level boss you have to go inside your giant robotised alter ego (top). A sumo fight, *Goemon*-style: beat the other player, but don't fall off... (above)



Here *Goemon* has landed on some rolling stock after falling down the enemy mine



This bubble-blowing Flintstones car can jump huge gaps, and is about to become very useful



A difficult level this. Ride the back of this dragon and watch out for those fireballs

Night Trap

Format:	3DO
Publisher:	Virgin
Developer:	Digital Pictures
Price:	£50 (import)
Size:	2 CDs
Release:	Out now (US)

Digital Pictures had considerable success with *Night Trap* on the Mega CD, mainly due to its adverse publicity. They're now hoping to emulate that success on the 3DO.

Many would argue that the 3DO system deserves original titles, not just hand-me-downs, and after spending several hours playing, sorry, interacting with *Night Trap*, **Edge** is inclined to agree.

A group of five teenagers disappeared after spending the night as invited guests at the house of Mr and Mrs Victor Martin. The Martins claim that the teenagers left their home on Sunday night, but after thorough investigation the police have failed to turn up any evidence of their whereabouts. The case is then turned over to a Special Control Attack Team, SCAT for short, and that's where you come in.

Using an elaborate security system, containing surveillance cameras and carefully situated booby traps, you're sent in to investigate. It soon becomes apparent that the teenagers didn't just disappear – they were abducted, and by a band of evil Orgs.

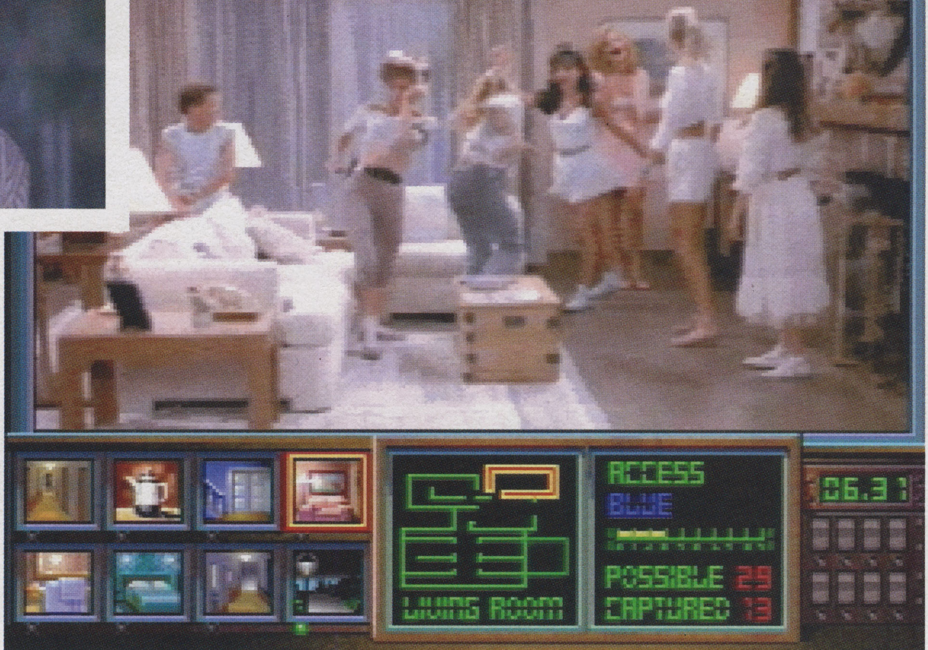


Listen in carefully to all the conversations, they offer advice as well as amusement

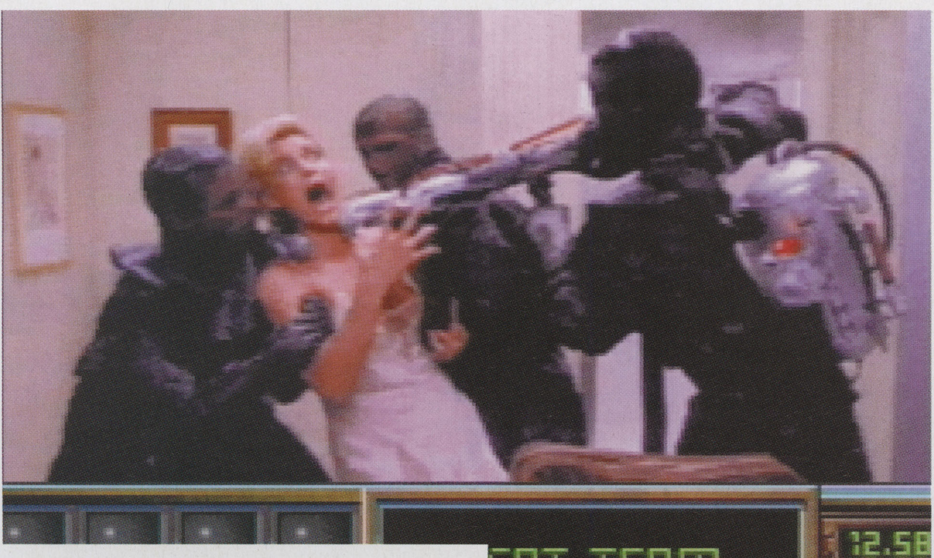
Five more teenagers are on their way to the house but this time, unknown to anyone else, one of them is a SCAT member. You have to save and protect all the teenagers by switching from camera to camera and capturing the Orgs in the traps situated



A shattered American dream? One minute the star of a popular sitcom, and the next...



Whilst the Orgs run rampant, the kids party on down: *Night Trap* is full of these distractions. Even though you have eight surveillance cameras at your disposal, keeping track of all the events is still quite tricky





The Orgs may look harmless, but after you see scenes like this (left) and (above) you begin to realise otherwise. (You could die laughing)

The violence

Night Trap couldn't have made a bigger impact when it was first released on the Mega CD. It wasn't because the game was so good, it was because it was one of the first games to receive a British Board of Film Classification rating and no one under 15 years of age could play it. Of course, kids of all ages wanted to know what all the fuss was about, and so sent their parents out to buy the game for them. Children all around the country crept into their bedrooms, loaded up *Night Trap* and eagerly awaited something really awful to happen, and it never did. Apart from the two scenes shown opposite, there's very little to separate this from any other interactive movie/game. In fact, after playing *Night Trap* children did indeed scream, but with laughter not fear

around the house.

Aside from the improved graphics and presentation, there's little else to suggest this is a superior version. The plot remains the same, the actors haven't changed (Kimberley from Diff'rent Strokes is still there), and the Orgs still walk around the house as though they have a severe spinal problem – only it seems even more amusing this time round due to the clarity of the graphics.

In an attempt to heighten your interest, the trap controls are protected with an access code – in the form of six colour variations – and the correct access code must be entered in order for the traps to work. But there's not much more to it. The game soon becomes dull once you discover when and where an Org will appear, all you're left with doing is pressing a button at the right time to set off the trap.

Night Trap does have an intense atmosphere and has converted quite well, but it's just that it's, well, *Night Trap*. With the limitations of the CD it was never a brilliant game on Sega's machine, and sadly the same can be said of this 3DO version.

Early adopters of the 3DO system will no doubt state loudly that this is a great game, but beneath the enthusiastic exterior there will probably lie a very worried and unconvinced individual. The wait for a really decent FMV game continues...

Edge rating: **Five**/10

Mega Drive







Trapping an Org couldn't be simpler: wait for your 'Trapomiter' to register full, then simply press your button. The traps themselves vary depending on which room you're in (above), but they all have the same effect



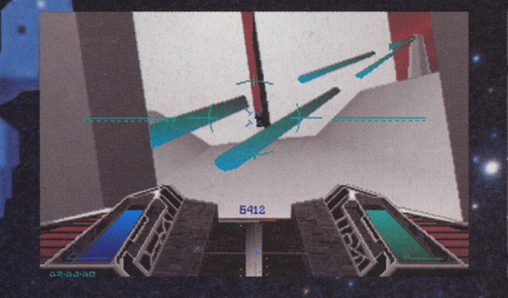
The Orgs prepare themselves for their first victim. The nasty looking contraption is a kind of neck truss with which they secure their victims

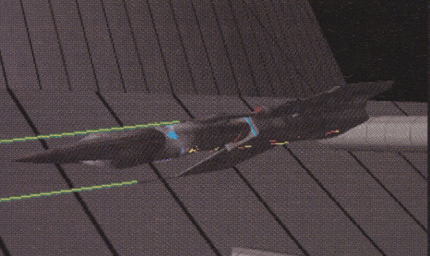
DELTA V

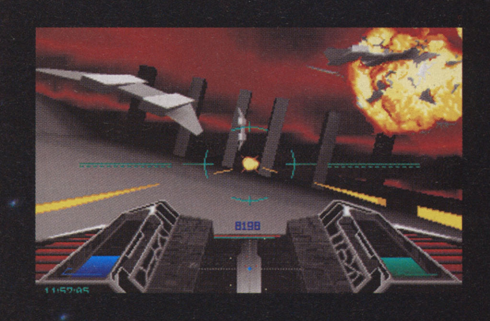
IT'S NOT A GAME . . .

YOUR MISSION: You control the most agile racer known to man as you fly down the 256 colour, 3-D, polygonal-shaded landscape at speeds where thought and action are one and mistakes are paid for in blood! If you and your Trace Vehicle survive, use your bonus points to modify its armour, firepower or speed to suit your style, then jack back into the Net for another Run!

In Delta V, a new type of Virtual Reality has been brought to the PC!







≥ L6 12-09-2147 - 17H34.48

≥ "So chummer, you want to know about runnin?

≥ "The Net's the most dangerous cyber-dream you'll ever have, 'cept it's not a dream. You gotta be ruthless and quick, huggin' the lattice like an Olthan lungworm on a Borian air-grazer. Once you jack in, it's just you and your Trace.

≥ "Like I always said, Netrunnin' is like a drug, the speed gets you higher than a 'ject of Cephilene Blue, but a mistake'll leave you deader than a jacked out straightliner.

≥ "That chum, is as permanent as it gets . . ."

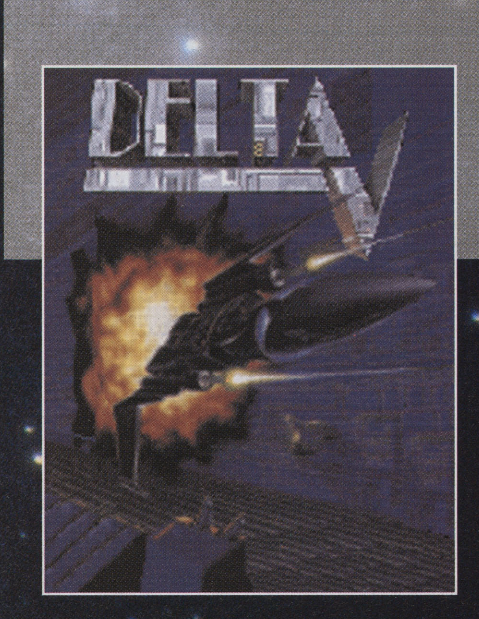
≥ END

≥ GROTHAN JHIR, ex-Netrunner.

IT'S A STATE OF MIND

Available on: IBM PC AND COMPATIBLES
(VGA, minimum 386/33 processor, minimum memory 640k Ram, 2Mb EMS memory and high density disk drive required. Sonic support: Roland™, SoundBlaster and Gravis Ultrasound.)



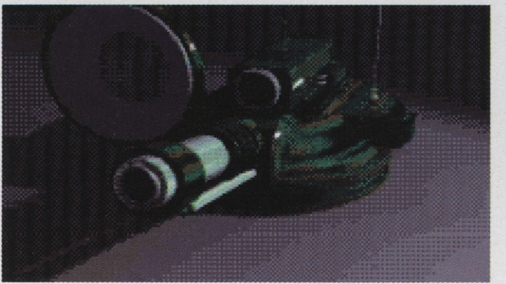


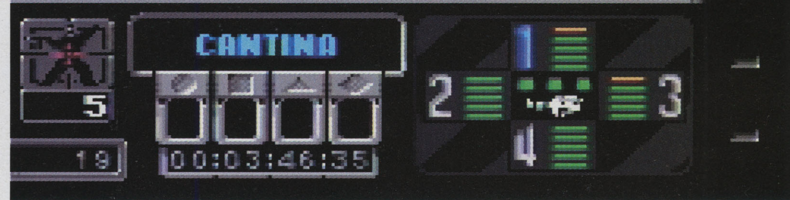
BETHESDA SOFTWORKS™

Ground Zero Texas

Format:	Mega CD
Publisher:	Sony Imagesoft
Developer:	Digital Pictures
Price:	£50
Size:	2 CDs
Release:	March







Although lavishly produced, *Ground Zero*'s point and click gameplay fails to impress. That cowboy isn't really a cowboy (top), he is in fact an evil and repulsive Reticulan, who has spotted one of your BattleCams (left). It's time to show him what you're made of...

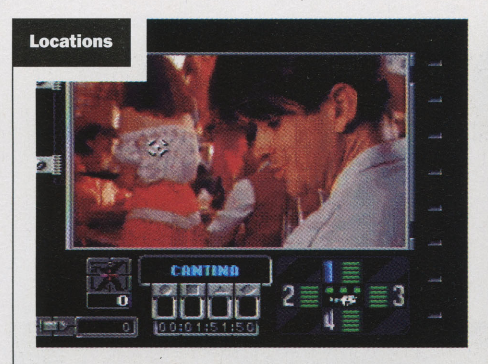
It's a well known fact that the Mega CD is in dire need of good quality titles. So far there hasn't been the tidal wave of great games that was expected, and as a result, Sega's machine is finding it very hard to keep afloat on today's technological ocean. Sadly, unless something drastic happens and soon, it seems as if the Mega CD could well find itself nestled beside Amstrad's GX 4000, looking up from the bottom of that ocean.

Attempting to throw out a lifeline, Digital Pictures (in conjunction with Sony Imagesoft) have produced their third 'interactive movie' – *Ground Zero Texas*. But unlike their other two games, *Night Trap* and *Sewer Shark*, *Ground Zero* had the benefit of a really huge budget. To ensure that it would be a professionally produced product, a vast sum was spent on lavish film sets, explosive stunts and a large cast of characters.

Set in El Cadron, a shabby little Texas border town, you 'play the part' of a tactical military expert. For some unknown reason, aliens – Reticulans – have decided to invade El Cadron and they, being the sophisticated aliens that they are, (and certainly not due to wardrobe limitations, oh no) have the ability to disguise themselves as humans. You are armed with four BattleCams, each one outfitted with a particle beam and all strategically placed overlooking an active part of the town. Your job is to seek out and destroy all the Reticulans. In each location you have an agent working undercover, offering some helpful advice – but be warned, some can turn nasty as the plot unfolds.

The action is not as stop-start as it is with most games of this type, and thankfully you're always advised where to go so as never to miss any of the action. But, and it has to be said, the action is *so* samey. Okay so the plot is fairly inventive, a strange mixture of science fiction meets the wild west, and the acting is very good, but for all this brilliant presentation, all you're left with doing is pointing a cursor at the bad guy and pressing the button. It's a problem that Sony and Digital Pictures seem to have overlooked, and

Locations









There are four main areas of activity: The Cantina (top left), Main Street (top right), Plaza Square (above left) and a Hotel Window (above right). In each of these locations you have an agent working undercover who'll give you codes throughout the game – but only if your sharpshooting skills are up to scratch

Shooting Ground Zero

Ground Zero Texas plays similarly to other games of this type, but due to the great acting and directing, the whole thing is far more believable. **Tom Zito** – Mr Digital Pictures himself — stated that it took around three weeks to shoot all the action for the game, and the finished version is reputed to have about 110 minutes of full-motion video.

The credits for the game read like a who's who of the film industry: it was directed by **Dwight Little**, whose previous films include Halloween IV, Marked For Death and Rapid Fire; the story was co-written by the chap who co-wrote Robocop, **Ed Neumeier**; and all the spectacular stunts were coordinated by **Hubie Kerns**, who worked on Rambo III and Star Trek II.

All major movies require sets, and *Ground Zero Texas* was no exception. It had a purpose built set constructed in the middle of a desert, just north of Los Angeles. The final production bill for the game ran to over $3,000,000.



Second mission

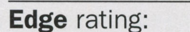
One of these three areas contain the Reticulans' armoury, now it's up to which one you choose

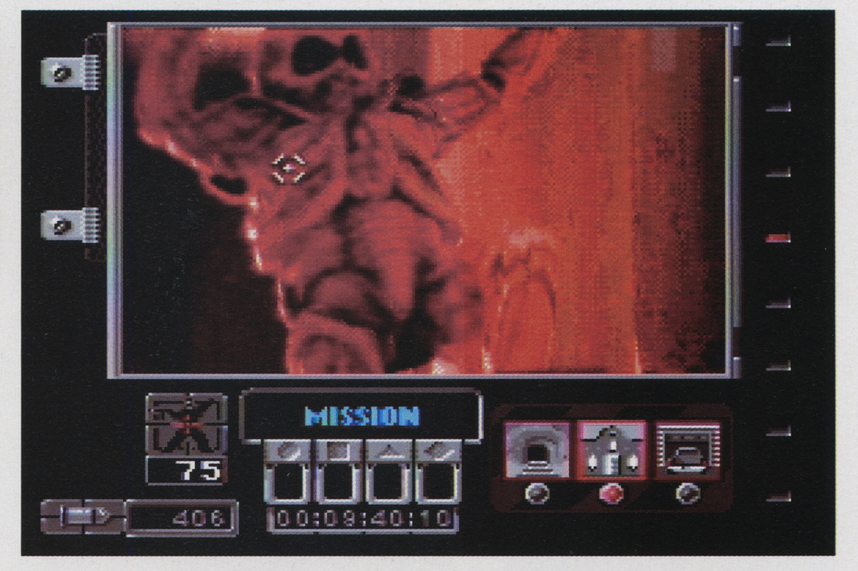
no matter how many millions are spent on producing a film, the game will always remain this linear on CD.

Ground Zero proves that throwing money at a problem never works. This game doesn't break the mould, it's just another in a long line of interactive shoot 'em ups. With the huge storage capacity of CD, programmers would be better off rechannelling their efforts into more action orientated games. Core did it with *Thunderhawk*, a game that could never have got off the ground without the Mega CD.

One interesting point, the American advert for *Ground Zero* boasts: '*Ground Zero Texas* will probably revolutionise the way games are made in the future' – for everyone's sake, let's hope so...

Edge rating: **Five**/10





This isn't a Reticulan, it's Michael Jackson, and – oh no – he's melting...



If you're unsuccessful, your commander is forced to dance the 'Bolero' with the Reticulans

Mortal Kombat II

Format: Coin-op
Publisher: Midway
Developer: In-house
Price: N/A
Size: N/A
Release: Out now

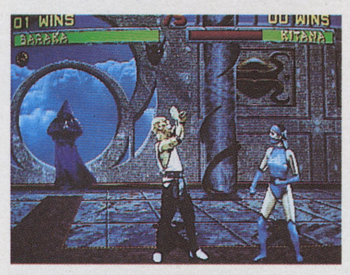


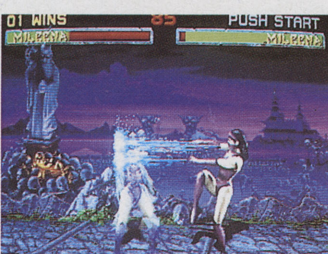
Lui Kang returns from the first game faster and stronger, and Mileena is a totally new character



Kitana shows off her fan wave. Useful for lifting opponents off their feet, but not much else







Old boy Cage confronts the new and powerful Jax (top) while the hideously disfigured looks of Baraka seem to have stunned Kitana (middle). Mileena releases her sias on her alter ego (bottom)

Remember the original *Street Fighter*? The one with the ludicrous, velocity-sensitive pressure pads which, after a few minutes of good, solid combat, would mysteriously never work again? The one with the big, interestingly chunky character sprites but mildly unsatisfying, repetitive, bizarrely random and non-strategic gameplay?

Well, apart from the bit about the velocity-sensitive pressure pads, this brief and tearfully tragic yarn of *Street Fighter* could well be applied to the original *Mortal Kombat*, which was very much 'all show and no go'.

But then there were two. Strangely enough, just as the sequel to *Street Fighter* virtually redefined the nature of the game's look, content and gameplay mechanics, so *Mortal Kombat II* aggressively slashes many of the original's errors and difficulties into a twitching heap of meat and hair, leaving us with a decidedly more healthy, glowing and more desirable creature in the process.

Faster, bigger, smoother, sleeker, gorier. More characters to control, more fighting zones, more moves, and loads more secrets – there are many new death moves to find and now even secret opponents to discover.

The actual shoeing takes place before a variety of ominously decorated backdrops (one, the equivalent of the original game's Pit zone is surrounded by a particularly despicable variety of green, probably corrosive, mucus). The inane board-breaking bits have gone and so have the slightly forced 'Endurance' matches in which you had to fight two fighters in succession.

Things have been tweaked sufficiently to



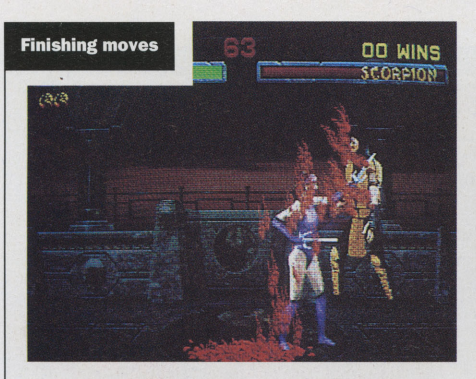


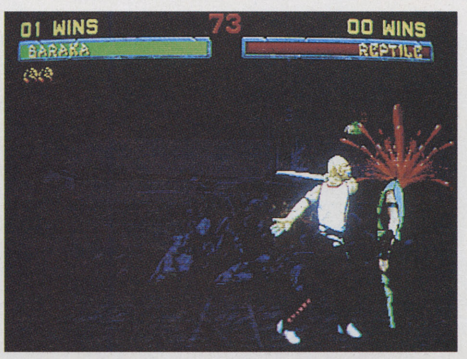


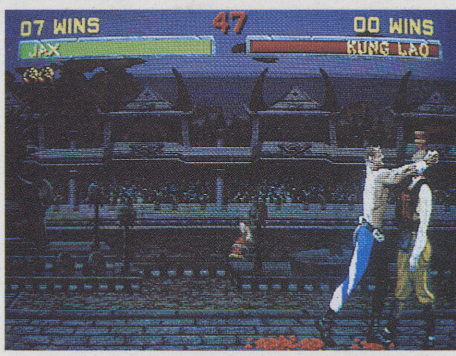
Characters

***Mortal Kombat* only had seven characters to choose from: this sequel has twelve characters, five from the original and seven new ones. Kano and Sonya are the ones not to make the sequel. There's also rumoured to be at least three hidden characters, but just how to access them is another matter...**

Finishing moves







Each of the characters has at least two finishing moves – except the master from the first game Shang Tsung. Since he has the ability to change into any of the characters, he has no need for his own death move. Mileena demonstrates her finishing move on Scorpion (above). Baraka decapitates poor old Reptile (above right) while Jax nimbly smashes open Kung Lao's head (right). Oh well, that's three finishing moves down, only 19 more still to learn...

make way for plenty of 'combos' – that's fast, rapid, unblockable combinations of moves for beat 'em up virgins. The fighting is less repetitive and frustrating, the sound is fantastic, and it's just all been miraculously transformed into a well-rounded, impressively designed, mercifully playable beat 'em up.

You will need a high level of dexterity, a strong stomach... oh, and an open mind would be nice. Look out for the inevitable console versions soon.

Edge rating: **Nine/**10

Secret bits

Gore galore! The designers have sneakily obscured many aspects of *Mortal Kombat II*'s gameplay with an intriguing and effective air of mystique. None of the standard character moves are revealed and, with each character reportedly having multiple, complex-to-execute fatalities (or 'finishing moves') at their disposal, you'll need to put yourself through a hell of a lot of experimentation and coin inserting before you grow into a vaguely confident fighter. In a way, it's the nearest that beat 'em ups have ever come to a sort of training process. Here's a few of those ultra-gory finishing moves, complete with their relevant joystick/button combinations.

Baraka
Nasty, mutant monster-type with lots of teeth and a couple of sleeve-concealed swords.
Move: Block, Back, Forward, Down, Forward, Low Punch.
Effect: He slits opponents up with his swords, lifts them into the air screaming, and lets the blood drain out of their bodies. (Nice huh?)

Mileena
Bemasked young lady with a pair of hideous sias (long ninja daggers).
Move: Forward, Back, Forward, Low Punch.
Effect: She rapidly slices opponents up with her knives.

Liu Kang
Stereotypical Kung Fu-kicking, high-pitched wailing, torso-exposing Japanese fighter.
Move: Down, Forward, Back, Back, High Kick
Effect: He appears to turn into a large dragon who swiftly devours the body of his opponent.

Jax
A large black gentleman who's good at fighting.
Move: Forward, Forward, Forward, Low Punch.
Effect: He smashes his opponent's head in a bloody pincers motion.

Fatal Fury Special

Format:	Neo-Geo
Publisher:	SNK
Developer:	In-house
Price:	£165
Size:	150 Mbit
Release:	Out now

Neo-Geo owners guess what? A new game has arrived and it's not at all what you'd expect. It's a sort of platformy shooting arcade adventuring type thing, where two swishly dressed characters face one another and play catch the projectile.

Oh alright, it's yet another beat 'em up – the third in the *Fatal Fury* series to be precise – and in spite of the amount of competition on this platform, this latest addition is still a rather good game.

So what's so 'special' about *Fatal Fury Special*? For a start, there are more characters to choose from. The first *Fatal Fury* only had three, the sequel had eight, but here you can choose from 15 bone-crunching bruisers. All of them have their own unique fighting style and all come with an assortment of special moves. There are even hidden 'power blows' that when executed take off huge amounts of your opponent's energy. Graphically, there are some new vibrantly coloured backgrounds – the bridge level is even more impressive – and all of them now go through a day to night transition.

With the exception of a few new tunes, the music and sound effects remain much the same: no bad thing this as they were excellent to begin with. Expert players among you will be delighted to hear that there's a surprise ending in store, but only if you defeat all the opponents without losing a single round.



Supplied by: KT Konsols (0847) 66949

The dreaded 'Dark Kaisee' – Wolfgang Krauser – is the biggest and strongest competitor in the *Fatal Fury* tournament. He stands over two metres high and has four very interesting special moves. His opponent here, the money-grabbing mauler Chin Shin Zan, lets loose with a thunderblast powerball

The characters

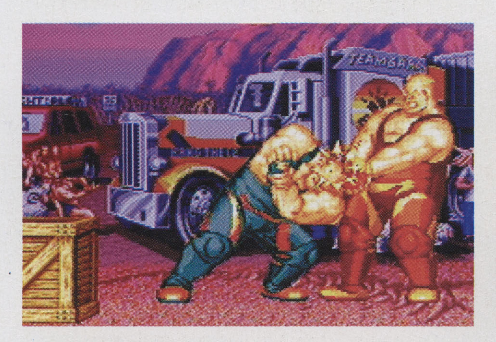
15 of the *Fatal Fury* series' top stars gather in what must surely be the ultimate fighting fix. One face is missing from this line-up, and that's the face of… well, we couldn't spoil it for you now, could we?

The **Characters**

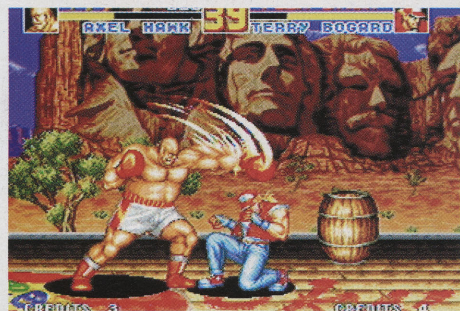
Fighting games rely on two major ingredients. The first is lots and lots of special moves, and the second, well, having lots of characters to fight with and against. It may be fun to throw fireballs into open space for a while, but it would be infinitely more fun to have someone to throw them at, wouldn't it?

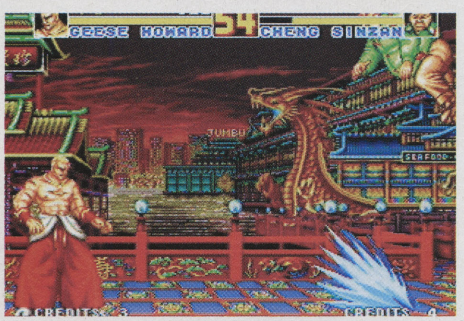
It just so happens that the *Fatal Fury Special* mixture has both of these vital ingredients. In fact this 150Mbit cartridge is positively overflowing with characters and special moves, more so than any other fighting game. Here are some of the more interesting ones…

Kim Kap Hwan, fights out of Korea and is lightning fast. His face stamping flying kick is both effective and curiously satisfying. **Tung Fu Rue**'s home town is Hobei in China. He may be small in stature but his Power Wave and Shock Blow – to name two of his four special moves – more than make up for this. The aptly named **Duck King** uses breakdancing moves to bust up his opponents, while the iron-knuckled pugilist – **Axel Hawk** – uses Tornado Upper cuts and the Axel Dance to hurt his.













The fights

Big Bear fights his alter ego (top left), while Tung Fu Rue demonstrates his 'shock blow' to Chin Zan (top right). Terry Bogard fails to avoid a blow from Axel Hawk (centre left) as Geese Howard lets loose his 'wind slice' (centre right). Duck King attempts a kick while Kim Hwan gets it in the face (bottom)

So there you go, what more could any self respecting Neo-Geo fan ever want in a beat 'em up? *Fatal Fury Special* looks good, has more characters, sounds great, plays brilliantly and has loads of hidden features.

But why, you ask yourselves, would I want to buy yet another beat 'em up for my machine? Well, given that a) you have an obscene amount of money and b) you wouldn't have bought a Neo-Geo in the first place if you weren't a beat 'em up fan, you'd be pretty daft to miss out on this as it's the best game in this excellent series, and the second best beat 'em up (after *Samurai Shodown*) available on your system.

Edge rating: **Eight/**10

BE AFRAID...
BE VERY AFRAID

The long-awaited CD ROM revolution arrives at last in the February issue of *PC Gamer*, with a glut of games that bring your darkest nightmares to life. *Critical Path*, *Iron Helix*, *Journeyman* and *Microcosm* are gloomy, scary and atmospheric – but are they any good? Our definitive CD reviews special sorts the men from the boys. If you want to see the latest in CD software, you know where to come...



PC GAMER

Smarter than the average
PC games magazine

PLUS! Over 35 new games reviewed – the definitive verdicts on the games that *really* matter from the best reviewers in the business – including *Alone In The Dark 2, Campaign II, Daryl Gates' Police Quest, Legend Of Kyrandia 2, Unnatural Selection, Terminator: Rampage, Pinball Fantasies, Dungeon Hack, Gabriel Knight, Star Trek CD*... and *'Allo 'Allo!*

SCOOP! Exclusive previews of *UFO*, *Star Reach* and *Battle Isle II!* Plus top tips for *Frontier*, *Sam & Max* and – *yes!* – many more.

STILL THE BEST COVERDISK! Featuring an exclusive, fully-playable demo of MicroProse's *NFL Coaches Club Football!*

NOT TO MENTION! Oh, what's the use? We could go on all day. If you're not already convinced that *PC Gamer* is groovy and great, you never will be. But admit it: you are, aren't you? Thought so. It "hits the streets" on Thursday 27 January. So don't you forget. Write it on your hand now. In tattoo ink.



Voyeur

Format: CD-i
Publisher: Philips
Developer: Philips POV
Price: £40
Size: 1 CD
Release: Out now



The 'adult' content of the disc, that resulted in its being awarded an 18 certificate, is frankly a bit tame. About as explicit as a raunchy episode of *Brookside*, it all becomes monotonous after a while

Just like the movie Who Framed Roger Rabbit, it takes about ten minutes playing *Voyeur* before you stop wondering how the effects are created and you start to sit back and enjoy them. The bluescreening technique *Voyeur* uses to incorporate footage of actors and props into computer-generated backgrounds is startling at first, but soon becomes convincing, working just as well as did the mingling of cartoons and live-action in the Zemeckis film.

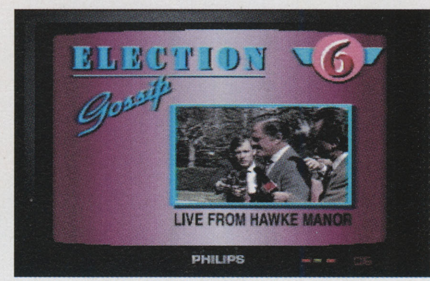
In fact, the technical execution of the entire project can hardly be faulted. The prerendered graphics are varied and realistic; the music is atmospheric and at the same time unintrusive. Careful data management cuts CD access times down to a minimum to keep the pace of the story cracking along, and even the acting is fairly unembarrassing, in a tacky American TV-drama kind of way.

Billed as 'the first real interactive movie', *Voyeur* casts you as a nosy neighbour of the Hawke family. Your video camera is trained on the windows of Hawke Manor, and it's your task to expose Hawke Senior for the nasty fellow that he is, by videotaping key conversations and items of evidence.

The problem is simply one of interactivity.



The story opens with Reed Hawke's advisors romping through a brief bondage session



Here's the man himself: Presidential candidate, blackmailer and murderer Reed Hawke



Inevitably there's a lesbian interlude – certainly the most gratuitous piece of titillation



(Above) Reed's sister Margaret knows what *really* happened to her father. (Below) Tearaway niece Chloe is a liability to his campaign

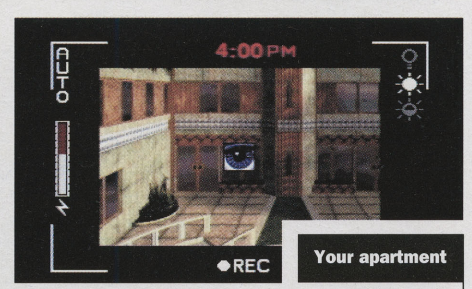
(Above) Jessica's environmental concerns are a threat to her father's business. (Below) Her brother Zack feels snubbed by his arrogance

The **victims**

Each time you play *Voyeur*, a different member of Reed Hawke's family will attempt to upset his plans for the Presidency. There are four characters with reasons to betray him, and their motives becomes apparent as the story unfolds over the course of a weekend. Unfortunately, it's very hard to tell which one is going to be on the receiving end of Hawke's displeasure (and get murdered) until the final moments of the game. Each of the four plot threads are present no matter who the victim will be, so there's always a lot of repetitive irrelevance.







Your Philips TV keeps you abreast of the outside world (above). The cop who arrives to view your evidence is frequently unimpressed (below)

As you focus your attention on the Hawke residence (above), icons appear in the viewfinder, informing you of events of interest (below)

Your **apartment**

All the action is viewed from the comfort of your apartment. The window looks out onto the front of Hawke Manor, and your video camera is at the ready to tape evidence of wrongdoing. You can just sit back and watch the television if you prefer, either for news about Hawke's campaign or to review the tapes you have recorded. If sufficiently incriminating footage has been gathered, you can send a tape to the intended murder victim to (hopefully) warn them in time, or call the police with proof that implicates Reed Hawke in their murder if your warning arrives too late.

The actual gameplay – moving your camera from room to room in an effort to catch the significant moments – is intriguing enough the first few times, but the conversations remain exactly the same on each play. And while there are four plot permutations, each with a different family member under threat, all the clues are present every time, so there's an awful lot of repetition.

Since your position is never more than that of observer – hence the title – there's no real way to influence the action, and therefore no proper or involving sense of interactivity.

Whilst enjoyable for a while, and laudable in its aspirations, *Voyeur* is ultimately an extremely shallow and rather disappointing experience.

Edge rating: **Five**/10

Alone In The Dark 2

Format:	PC
Publisher:	Infogrames
Developer:	In-house
Price:	£45
Size:	9 disks
Release:	Out now

Anyone who's marvelled at Sega's new *Virtua Fighters* coin-op will be instantly captivated by the visuals in Infogrames' long awaited sequel. The 3D animation is stunning – no surprise when some of the staff from top French development house Delphine (*Another World* and *Flashback*) defected to Infogrames early last year. The skillful French have concocted a magical formula here and, miraculously, we're not just talking about graphics.

While Delphine's games used polygons mainly for their animation value, *AITD2* and its prequel use them for a far more deserving cause – 3D interaction. The established collect 'em up gameplay in *AITD2* isn't that revolutionary – it's been the core of PC adventures for years – but a 3D environment has never been constructed as convincingly and impressively as this. And 3D adventuring has certainly never been this much fun.

Forget preordained scenes like those in *Dragon's Lair*, this is a welcome trip back to grass roots, hands-on gameplay – the sophistication and beauty of it all is just a pleasant bonus.

So what changes have been made with *AITD2*? For a start, it's a lot bigger. The first game was criticised mostly for being too small, and amending this was naturally a priority. The 210 different locations and perspectives now mean that you can enter a room and get up to four different views depending on where you stand. It's not perfect, and occasionally you'll still wish you could see more, but nevertheless, Infogrames are to be congratulated on this score.

But *AITD2* is also pretty gruesome. The three-dimensional combat is the same as before – *Virtua Fighters* style, that is – but now the violence is even more pronounced. Bullet-ridden bodies recoil with alarming



A rather unpleasant bathroom scene involving Ed, a smuggler and a wooden battledore









The intro demonstrates how your pal Striker came to a rather abrupt end. After climbing in through a bedroom window, a vicious little jester puppet comes to life and...



The beauty and realism of the animation simply can't be conveyed with screenshots. Here, Ed pauses in disbelief as a small cleaver-wielding chef waddles up the stairs pursued by approaching bad guys



Part one: the mansion

1 Edward Carnby arrives at Hell's Kitchen to track down his missing friend. 2 And then begins to realise *why* he's gone missing. 3 Using the stone sculpture in the gardens as cover. 4 Ed gets trapped in a corner as he tries to take out a guard. 5 The garden maze isn't a place you want to be stuck without bullets. 6 Uh oh! Looks like old Striker was dumped down here – poor guy. 7 Gunshots ring out – but where from? 8 Hidden in a sack is the Santa Claws outfit. Great disguise, huh? 9 The best way of dealing with lots of bad guys – position yourself in a doorway and let 'em have it...

realism, and this, coupled with the already haunting atmosphere, makes for a fairly nasty game. Be warned, if anything was guaranteed to give kids nightmares, this is it.

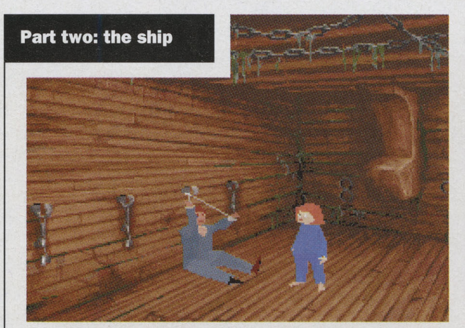
Sound plays an important role in creating this tension. Gunshots ring out with astounding clarity and footsteps even change as you walk over different types of flooring. With a decent soundboard, you'll get such nerve-tinglingly clear samples that the music is a comparative disgrace.

For the more conspicuous improvements in *AITD2*, however, you have to look to the gameplay itself. Character control is now more responsive, and the second half of the story accommodates the control of a second character – a cute young girl whose charming animation and abilities provide a welcome respite from the violence.

Whichever way you look at it, *AITD2*'s strongest card is its coupling of movie-style production with some of the best gameplay around. Yes, it's gruesome. It's bloody frightening if the truth be known. But it's also great entertainment. Buy it.

Edge rating: **Nine/**10

Part two: the ship





Grace's forté is guile rather than guns. The parrot (top right) is enchantingly animated



Saving Grace

So, you've been all through the house and the end of the game seems to be approaching pretty fast. That's where you couldn't be more wrong. The second half of the game opens up when you find yourself chained up in the hull of a ship (top left). Now taking control of the adorably animated Grace – the eight yearold girl you're supposed to be saving – you must find a way of releasing Edward from his chains while avoiding the ruthless pirates.



Recommended

reading

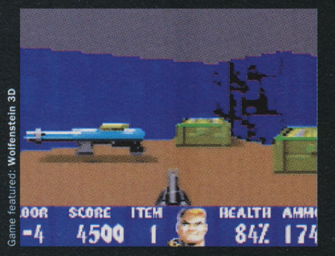
In which we preview a few of


Game featured: Equinox 2

Magazine: **Super Play**
Format: **Super Nintendo**
Price: **£2.50**

'**Your SNES** is producing dance tunes. Didn't know that, did you? First there was SuperMarioLand (which reached number 8), and now there's the Super Mario Compact Disco and even a *Street Fighter II* rap track coming out. Super Play blows the lid on the game music industry. And there's a huge feature on *Mega Man X*, plus the first review of it. Also reviewed are *Dragonball Z 2*, *Mystical Ninja 2*, *Lethal Enforcers*, *Space Ace* and *NBA Jam*. Plus massive guides to *Shadowrun*, **Equinox 2** and *Total Carnage*. Miss it and not only will you be uninformed, you'll be unfashionable.'

James Leach, Editor



Game featured: Wolfenstein 3D

Magazine: **Game Zone**
Format: **SNES**
Price: **£2.50**

'**The NES** redefined console gaming. The Super NES blew gamers away with raw 16bit power. Now Nintendo are going for their hat-trick. Project Reality is their new 64bit console, the machine destined to take gamers into the 21st century. Nintendo are going to tell what their new 'wunderkind' can do at an exclusive conference this Spring. Game Zone will be there and will be the first mag to carry full details of the new machine. But even as these plans take shape, the SNES just keeps getting stronger. *Elite* will finally make it to Ninty's finest, *John Madden '94* finally gets a UK release, as does the fabled PC blood-fest shocker, **Wolfenstein 3D.** Both of these, along with *NBA Jam*, *Humans*, *Pinball Dreams*, *Brett Hull* and every other cart that counts, get reviewed in Britain's boldest Super Nintendo magazine.'

Trenton Webb, Editor



Game featured: Sonic 3

Magazine: **Sega Power**
Format: **Sega**
Price: **£2.50**

'**The definitive** review of **Sonic 3** is just the beginning of the games-fest that is the March issue of Sega Power. Review is piled upon review, as the Power Crew deliver the goods on titles like *Jurassic Park CD*, *Ground Zero Texas*, *NBA Jam*, *Prize Fighter* and *Double Switch* – a new CD title starring Debbie Harry and Corey Haim. But the explosive fun doesn't stop there, because the Sega Power express then stops off at Las Vegas for a hot-from-scene report of this Winter's Consumer Electronics Show, before blasting off into the land of tips for the solutions to *Sonic Chaos*, *Landstalker*, and the deeply fabulous *Aladdin*. All this and a competition to make you drool, gibber, and the proud owner of something very, very expensive indeed. No, really.'

Mark Ramshaw, Editor

the other Future videogame magazines


Game featured: Rebel Assault

Magazine: **GamesMaster**

Format: **Multiformat**

Price: **£2.25**

'**It's all** so confusing, isn't it? Quantum mechanics' concept of discontinuously radiated energy? A holistic, psychosexual overview of human behaviour? Actually, we're talking about these 'computer' and 'console' thingies. Undoubtedly, there's a lot of 'em about and, should you be availed of at least partially functioning synapses, then you'll currently be twitching with the desire to dash out and obtain the February issue of the universe's finest and funniest videogames magazine. In it, we reveal loads of those secret *Mortal Kombat 2* coin-op moves and fatalities, take a look at how *Sonic 3*'s shaping up, and review *Eternal Champions* (Mega Drive), *R-Type III* (SNES), *Star Trek* (Amiga), **Rebel Assault** (PC CD-ROM), *Wolfenstein 3D* (SNES), *Greatest Heavyweights* (Mega Drive) and tell you precisely what you can bleedin' well expect for your cash. Unless there's something wrong with the way you look, smell or talk, then we'd be frankly staggered if you weren't already holding it in your hands… Get on with it!'

Andy Lowe, Editor



Game featured: Ground Zero Texas

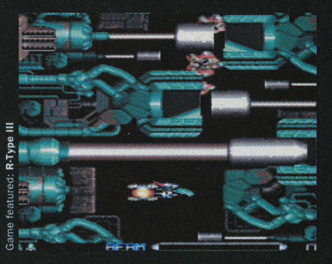
Magazine: **Mega**

Format: **Mega Drive**

Price: **£2.50**

'**If after** all your Christmas excess, you're looking for something to slow you down then you'd better try something other than the latest issue of Mega (on sale 20 January). For starters we've got a lovely in-depth preview of *Sonic 3* and an amazing nine pages of preview to back that up. On the review front we take a look at *Eternal Champions*, *Winter Olympics*, **Ground Zero Texas,** *Micro Machines* and loads of others. There's also a round-up of all the latest joypads about to hit the market, and on a more serious note, we take a look at the growing concern about violence in videogames as voiced recently by a Californian attorney general. But don't forget the tips, the final part to our *Landstalker* solution and all the other regulars that you've come to know and love. It's there for you, so why don't you go out and buy it.'

Paul Mellerick, Games Editor


Game featured: R-Type III

Magazine: **Total!**

Format: **All Nintendo**

Price: **£2.50**



'**This month's** issue of Total! brings you the usual brilliant reviews of all things Nintendo, with some superb titles treated to our usual uncompromising criticism. We take a look at *Wolfenstein 3D*, one of the most impressive and certainly the most violent SNES release of late. We also blow the lid on **R-Type III,** one of the best shoot 'em ups ever on the Super NES. We also have the lowest ranked game ever to appear in Total!, which gets the kicking it so richly deserves. What is it? you'll have to buy the issue to find out. There's plenty of Game Boy games to check out, as well as one of the finest games to appear on the NES for quite some time. There are competitions galore, an interview with Metro, the UK Nintendo champ, and an in-depth exposé of current and future Virtual Reality technology. It's all in the fabulous February issue of Total! In your local newsagent on January 20th. Seeya there.'

Frank O' Connor, Editor


Game featured: Alone In The Dark 2

Magazine: **PC Gamer**

Format: **PC**

Price: **£3.95**

'**The new** year period may traditionally be a slump time for decent software, but not the PC games scene – the February edition of PC Gamer kicks off 1994 with no fewer than 35 reviews of the latest releases! The likes of **Alone In The Dark 2,** *Campaign 2*, *Kyrandia 2*, *Police Quest 4*, *Micro Machines*, *Pinball Fantasies* and *The Terminator: Rampage* all come under the definitive PC Gamer spotlight, along with a new wave of CD-ROM titles that promise to turn your hair white overnight. Add to that an exclusive interview with Papyrus, the creators of *IndyCar Racing*, expert tips for *Frontier* and *Sam & Max*, scoop previews of *Battle Isle II* and *Star Trek: The Next Generation*, a guide to PC joysticks and a fully-playable demo of *NFL Coaches Club Football* on our HD coverdisk and you've got a magazine that sends just about ever other PC publication running for cover. Read us or weep.'

Gary Whitta, Editor



Photographs: Rob Scott

Archer MacLean, programmer of *3D Pool*, *International Karate+* and *Dropzone*, and one of the last one-man coders, in conversation with Edge at his Warwickshire home

An audience with: Archer MacLean

Edge meets veteran coder Archer MacLean – of *Pool*, *Dropzone* and *IK+* fame...

What with *Jimmy White's Whirlwind Snooker* being voted best game of last year it's hard to think that anyone hasn't heard of Archer MacLean. Apart from his name being on many a 3D snooker or pool game, you may recall a certain fast and furious karate game called *IK+* and a *Defender* style shoot 'em up called *Dropzone*. Both games were the fruits of his keyboard.

Archer lives in Warwickshire, and he has the distinction (besides being the owner of seven cars!) of being one of the few long-standing coders who still programs alone. Most of the others, David Braben aside, are now part of huge coding teams, or at least have setup teams to produce games in their style.

Archer started writing payroll software, and building his own computers around 1980. Then *Space Invaders* came out and he got hooked. *Dropzone* (1984) was his first shoot 'em up, on the Commodore 64 and Atari 800. It was 'inspired by *Defender*, but it's not a copy at all', he assures us. In '85 *International Karate* came out and that was number one in the charts in the UK, Europe and America. Then there was *IK+* in 1987.

In 1989 he started on *3D Snooker* and that took three years. In '92 he did *3D Pool* on ST Amiga and PC. And now he's doing Mega Drive *Snooker* and *Pool*, and also *Super Dropzone* on all major game consoles, including the SNES in Autumn this year.

Words by **Edge**
Answers by **Archer MacLean**

Edge So what programming languages are you particularly good in?

Archer MacLean I tend to find that I can even get back into programs I wrote ten years ago, whereas other people say they can't remember what they had for lunch yesterday. It's a bit of a big headed point but I do seem to be able to get into old code, like with the *Dropzone* conversions – I've more or less gone straight back to an old program I wrote ten years ago. And if there's a bug I just think, 'Oh that's just because of such and such...

I used to program in Basic to do the payroll stuff, so I'm obviously good at that. I used to do experimental mathematical stuff on a PC in Basic – because speed of development was there. Ball collision logic, that's very deep maths, that is. I simulated it all in Basic. I've also done a bit of Fortran, Pascal, funny languages like Forth, Z80, 6502, 6800, 68000, a few weird ones like one chip microcontrollers. I'm trying out

English too. (laugh)

Edge Yeah that's a tricky one. What's your favourite? What machine do you sit in front of and think, 'ahhh, here we go again?'

Archer From a nostalgic point of view I used to like the old Atari 800. It was just so far ahead of its time, it really was an 8bit Amiga – available 14 years ago. Very few people exploited it; *Dropzone* did. I also quite like 68000 because it's so universal. You can use virtually any register for any purpose, most commands work on everything. Whereas the PC is a real, utter, total, pain in the arse.

Edge Why is that?

Archer You can do impressive stuff, but you have to concentrate more on game design and visual appeal as opposed to technical feats. But as PCs get more powerful, rough edges in programming can get covered up by sheer speed and processing power.

Edge You can be as lazy as you like?

Archer It's beginning to get that way, but I think with the new batch of games consoles coming in two years' time you won't even have to be lazy, because as far as I see they do virtually everything that a programmer has ever had to specialise in anyway.

Edge They use libraries to make it easier to access certain effects.

Archer It's more to do with techniques that are being done in hardware. It's something a programmer would have to spend 11 of the 12 months of the year pushing the code to its ultimate speed to do. Now the hardware just does it automatically. You just say I want this there and at that speed, and it does it all in real-time. Unbelievable.

These new machines are going to make 3DO look about this big. (holds finger and thumb a centimetre apart)

Edge Do you think the development of these new machines is happening a bit too fast? Are things becoming obsolete before they're even out?

Archer Yes, the hardware at the moment is really steaming ahead. It's not giving developers a chance to get into them. I mean, what platform do you support?

Edge It's a bit like the bad old days of the mid '80s, where there was Spectrum, Amstrad CPC, Commodore 64, Atari 800, Atari ST, PC, Oric...

Archer But during '87 to '92 you had the good old Amiga and ST, and the PC, and you could get stuck in, put together a good game, release it. If it was good it would sell.

Nowadays if I started on a program for the Mega Drive that was original, well... for a start a publisher wouldn't touch it because it was original, not a licence. By the time I'd finished it, especially in my case by the time I'd finished it, the machine would be dead, gone, buried and forgotten about.

50% of developers go for CD stuff, and CD has vast potential for certain things, but people have to change game design. No-one, as far as I can see, has come up with a game yet that uses the CD system and its limitations properly. I don't know quite where that'll end up, I suppose if someone can invent a quadruple or maybe a hell of a lot faster CD system...

But there are big advances being made in Gallium Arsenide Substrate technology which means that chips can be made smaller, more dense, more powerful and about eight times faster. If that can be refined to make it economically feasible... Within say five years you're going to find that chips are going to be competing with CDs for storage. I also think that compression, decompression technology, is leading to the stage where now you can get



'When I designed my snooker table, I drew it by hand, worked out where everything was, then scaled everything from millimetre measurements on a real table, and typed it all in. It took ages'



Archer MacLean sits surrounded by his trophies: 'I did one shoot 'em up and got all these awards, then I did a beat 'em up and got more awards...'

Continued next page

four times the storage on an existing cart.

Edge What about these new machines? Which do you see as being the one that's going to make it big?

Archer I can't breach confidentiality, but I know in my mind from what I saw recently the one I think is just unbelievable. I'm aware of the technical specs of all of the machines. In the one case I'm talking about, yes, I've been down there and played with it and I just couldn't believe it. The computing power relative to an A500 is measured in the hundreds, and this is all on a little thing (makes size and shape of a Mega Drive 2 with fingers) costing about £200 or £300. These things are more powerful than the most powerful full-blown arcade machines I've ever seen.

Edge It's hard to see how a single person could develop software for such a beast…

Archer I think big teams of people putting vast amounts of stuff in is the only way to do it. One of the big things would be utility programs which encode the data in a much more sensible way.

Edge Smart utils to fill in a lot of the gaps?

Archer Yes, programs that do a lot of the donkey work for you. When I designed my snooker table, I drew it out by hand, worked out where everything was, then scaled everything according to millimetre measurements on a real table, and typed it all in. It took ages. Nowadays if you wanted to you could design a snooker table on a 3D package in 10 minutes. Get the program going, pull the table in, download it, and there's your snooker table.

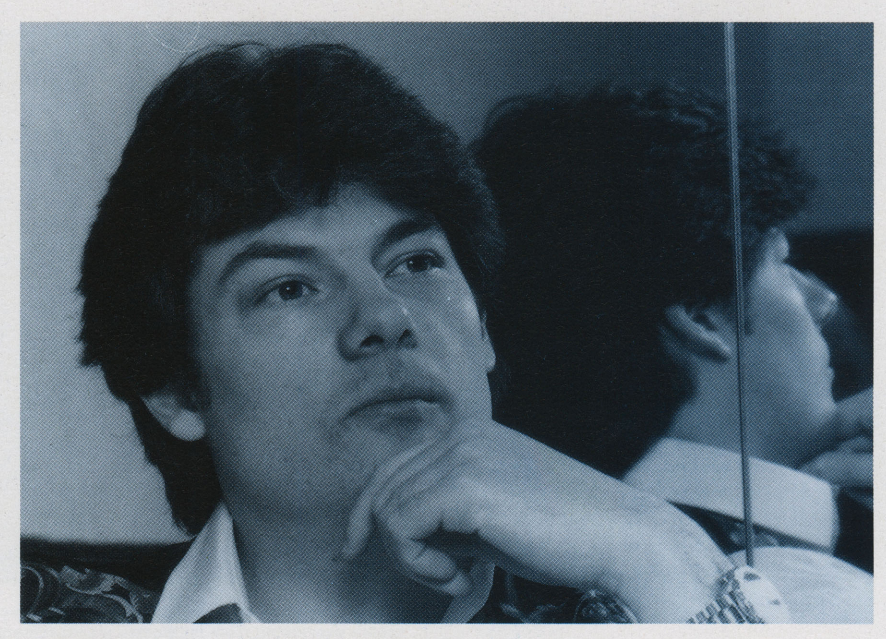
Edge What got you into 3D originally?

Archer I did one shoot 'em up and got all these awards, then I did a beat 'em up and got more awards… I thought, 'I don't like the idea of adventure games, they don't sell an awful lot, so I'll do a 3D game.' A lot of my contemporaries said 'blah, give it up, can't be done… all you've done is this and it's all simple graphics…'

If someone tells me something is impossible and I think it isn't, I go off and do it. I might take my time, I must admit I'm not the fastest developer in the world… Various publishers around the world will be nodding their heads when they read that. (laugh)

Edge What machines do you use and how do you develop?

Archer Until recently the main machines have been the Amiga and ST as host machines, and the PC. I do all the software development on the PC – all the graphics are done on ST and Amiga and uploaded. The three systems are linked together, all three can talk to each other. I've got a very fast assembler system.



'The taxman seems to think I'm a Colombian drugs baron, but basically I've played a straight bat. … I'd like to think that I'd got a nice little company up and running…'

I'm now starting to use the consoles – I'm trying to put *Snooker* onto the Mega Drive, and I'm about halfway there.

In the old days people just sat in their bedroom with the target machine costing £100, they bought themselves a £29.95 assembler and they just wrote games. Now you've got to spend a couple of years coming up with something, assuming you've got the experience, then program and develop the game, then you've got to persuade a publisher that this is going to be a good title. They won't give you a contract because you haven't got a track record, you can't get a track record because nobody will give you a contract. How the hell people get into the business now, I don't know. I think the only way into this business today is as part of a team.

Edge Answer an ad in the paper or something?

Archer And be a specialist in graphics or coding.

Edge Do you think that games were coded better when people had less to work with?

Archer The funny thing about old arcade games is that they've only got a 6800 or 6809 in them, old 8bit micros, but look what they're doing. Those were the days of seriously talented programming. That sort of ability is wearing off these days, although I like to think I've got a bit of that myself, and a few of my contemporaries have.

Edge You were all used to having 64K for everything…

Archer You couldn't just sit down and get it done in a couple of hours one afternoon, you had to work at it.

Edge No 100K samples…

Archer You had to be clever. Like the guy who did *Robotron*, *Defender*, *Stargate* and *Sinistar*… Eugene Evans I think his name was, I'd like to meet him. How he did all that in 1979-80 I just don't know.

Edge What will you be doing in five years time?

Archer I ask myself this all the time. But I can't even think about what I'll be doing next year! (laugh) The taxman seems to think I'm a Colombian drugs baron, whereas basically I've played a straight bat. So if the tax problems don't ruin me… I'd like to think that I'd got a nice little company up and running, and was a bit more mature than I am at the moment in terms of running a daily life.

Edge What would you do if you could, if you didn't have to earn a living?

Archer I like to do something more useful that wasn't so selfish, because there are plenty of people out there who I think do need someone to help them out.

I'd also like to do some really daft things. I'd like to run a theme park full of gravity rides, 'Archer MacLean's Alton Towers 2'. I'd also like to have a few hundreds acres of forest land and own a race track, and have a motor museum, have a track to drive the cars on – and have 100,000 members of the public to come in on certain days and pay for it all!

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Image created by Marcus Morgan



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Sleuth wanted

While some seem intent on greeting gamers with cloves of garlic and silver bullets, others are offering a warmer welcome. Fulfilling its role as custodian of our moving heritage, the **British Film Institute** has plans to erect a temple to the videogame, where devotees will be able to pay it homage. A museum-cum-gallery where every game ever made can be played or displayed is the aim. What the BFI needs is a walking, talking game encyclopedia who wants a job for three months tracking game titles and hardware. Interested?

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viewpoint

What's your **opinion**? **Write** and **tell** us: **Edge** letters, 30 Monmouth Street, Bath, Avon, BA1 2BW



Regarding the 3DO vs Jaguar war, a lot of my friends were all set to buy 3DO as soon as it hits the streets over here, until I sat them down and spoke logically to them about the pros and cons of each system.

For instance, why buy 32bit when 64bit has already superceded it? But onto the specs. If you want to run MPEG on your machine, Jaguar specs give MPEG 2 and 3DO gets MPEG 1. And you need the highest resolution possible to display full-motion video clearly. Jaguar has got a 768x576, 3DO has got a 648x480 – but it's really a 324x240 screen. And the Jaguar's speed is about 44Mips, 3DO is about 6Mips.

Most convincingly, though, the Jaguar will cost about £200, 3DO about £500. But what if you want to use CDs? Okay, spend another £100 for the Jaguar drive and you have a machine that runs carts and CD.

And as everyone should know by now, carts equal instant loading, while CD takes so long it has you nodding off. So Jaguar has the best of both formats, especially with its massive 400Mbit carts.

I haven't got anything against the 3DO system, but people should compare specs not just listen to hype.

Andrew Staff, Muswell Hill

Well, for starters, let's get our facts right. The MPEG 2 standard – which is designed for broadcast quality TV transmission – is still in development, so both systems can either go for MPEG 1 or wait until MPEG 2 is finished. Either way, it's very likely that both 3DO and Jaguar will use the same MPEG system.

You are correct in saying that 3DO's resolution is misleading: its actual pixel resolution is 320x240. However, while Jaguar can display screens as high as 1,000x1,000 (1,440x1,000 is also technically possible), this takes a load of processing power. Most apps will use the 320x240 (NTSC)/320x287 (PAL) mode.

Again, while rated at 55Mips, Jaguar will only usefully run at around 30 – although this is substantially higher than 3DO's 6Mips rating.

All this does is to highlight the dangers of specs: they are terribly misleading and, size, as they say, isn't important. It's what you do with it that counts. Look at *Tetris* on the Game Boy: one of the best games on the planet, and that's running on an 8bit Z80A…

After going to the Future Entertainment Show at Olympia and the one before that at Earls Court, I felt that I had to write. Before the first FES was held, it was heralded as a show to equal the CES in America and it was touted as having everything from new games and new hardware to other new bounds in computer technology.

When I went I was rather disappointed. There was no brand new hardware or software releases that hadn't been seen in



The Future Entertainment Show – not quite up to CES standard? (See letter from A Wills)



Photograph: Peter Canning

Panasonic's REAL 3DO machine is a powerful beast. But the specs are misleading – it doesn't *really* have a 640x480 screen resolution…



Photograph: **Stewart Whale**

… Whereas Atari's Jaguar is a mighty creature, technically capable of displaying 1,440x1,000 pixels. (See letter from Andrew Staff)

Japan or America already. Sega's and Nintendo's stands were merely banks of TVs showing games that were already available in England.

I was disappointed but hoped that the next one would be better. I saw many things about the second one that encouraged my opinion, such as the fact that Konami were to attend and that the 3DO and Jaguar were to be there. When I arrived I immediately looked around and all that grabbed my attention was a playable 3DO on an importer's stand and a couple of new Konami games.

I'm not disputing that the two shows weren't fun, far from it, but I am saying that it can hardly be likened to the CES.

Why don't big companies such as Sega and Nintendo show their new technology and have press conferences etc, like they do at the CES? I know the British (and European) markets aren't as large as the US market, but why can't our appetites be whetted with new technology? I'm sure that a lot more interest in the individual machines and games would be generated if they did.

A Wills, Haslemere

It's still early days for the Future Entertainment Show. At the moment, it's very much a fun public event and isn't really the place to launch new products. But as the show grows in size and importance we may well see it alter. It would certainly be nice if Europe had a show to rival the CES.

I am writing about the opening editorial of **Edge** four, and the recent announcements that Sony and NEC are to enter the high-end multimedia stakes, along with the likes of CD-i.

I see it as an overt demonstration of contempt for the consumer that we are faced with some six (at least) high-powered gaming systems – already here or about to make their way here between now and 1995. What bothers me is that this isn't a matter of concern to most magazines and to consumers as a whole.

Instead of saying how great each successive machine is over the last one, they should really be saying, hang on guys – enough's enough.

I am also sorry to see that this isn't a matter of concern to software houses either. I can't blame them entirely as I'm sure they want to sharpen their programming skills and would also find it terribly hard to turn down money from the likes of NEC and Sony, but I would like some reassurance from them that they aren't helping to perpetuate a potentially intolerable situation like this.

Of course, you might say that this is a good thing: you've got to progress, etc, etc. But tell that to someone who spent large sums of money on a 32bit machine and similarly expensive pieces of software, only to find it obsolete.

Jamie McLean, Glasgow

True, the market will be badly fragmented in 18 months time, but it's not quite as terminal as you make it sound. Discounting NEC (they probably won't launch in Europe anyway), the other players – Sega, Sony, Nintendo – are so big that any machines they launch will be well catered for with software.

Obsolescence is a factor with everything, from cars to VCRs to hi-fi and kitchen equipment.

But as new kit appears, prices fall and technology improves. Okay, the consumer can be at risk, but that's why you read **Edge**, isn't it?

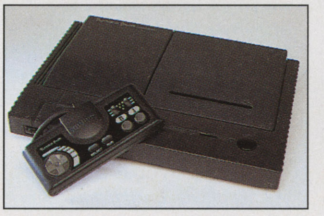


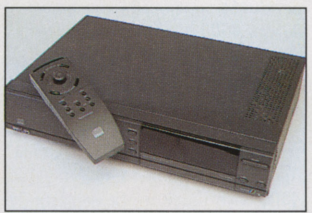
Illustration: Paul Kidby

Sony's PS-X (which will most likely look nothing like our artist's impression). Welcome addition to the multimedia market, or simply another ploy to take your money? (See letter from Jamie McLean)









Photographs: Peter Canning

Four games machines: they all take standard five-inch CDs, but they're all completely incompatible. (See letter from John Kingham)

I'd just like to say I wish everyone would stop going on about an industry standard. The technology just hasn't settled down enough for this to be possible. If we chose a standard now, all future hardware would be crippled, just as PCs are now. The cost of making new hardware downwardly compatible to old, out of date hardware, is just a waste.

A standard only becomes a standard when it is difficult to improve upon. This is obviously not going to happen for a while yet within our industry. First there was CD-i, then CD32, then 3DO, then Jaguar, then Sega Saturn, then Project Reality. But then what? The CD64, the 3DO Mark II?

I believe that a hardware standard should only be sought when certain parameters are met, ie, graphics are as photorealistic in a 3D environment as is meaningfully possible. And graphical effects can run any number of colours at any speed, with no loss of quality. And hardware sound effects are of at least CD quality. All for about £200.

Once this level of hardware is reached, hopefully within ten years there will be a little room for improvement and hence a standard is reached.

John Kingham, Eltham

It is a little odd that the giant electronics companies all agree to produce audio CD players to Philips' CD standard or video recorders to JVC's VHS standard, yet seem so completely obsessed with setting their own criteria for what constitutes videogame or multimedia hardware.

But, as you say, until the technology is so advanced that further improvements are purely aesthetic, the problem looks set to continue. And by then it's just possible we'll all be plugged into home VR machines, buying standard software on CDs. Now there's a thought...

The general impression in the computer industry is that the PC is far superior to the Amiga in terms of speed. I do not wish to start the 'my computer's better than yours' ball rolling again, but I must clarify the matter.

When software companies write games for the individual formats, they produce a PC specific version with texture-mapping, gouraud shading et al – this is because they develop for the high-end PC – the 80486 model. When producing an Amiga version, they write the game with the Amiga 500/1200 in mind. This means they have to strip away the 256 colours and all the extra features, which annoys me more than I can say.

I must make clear to software developers that there also happens to be a high-end Amiga out there – it's called the Amiga 4000, and features a 68030/40 processor. This machine is so much faster than an 80486 PC, and – if taken advantage of – can blow any PC away.

Software companies may argue that because high-end PCs have a larger user-base then high-end Amigas, they can afford

Continued next page

viewpoint

to develop software for 486-equipped PCs. This theory simply doesn't hold water. The reason people started purchasing powerful PCs was because of games like *Wing Commander* – a game which couldn't be run on anything less than a good PC.

Similarly, if a game was produced specifically for the Amiga 4000 (which costs roughly the same as a 486 PC), sales of the machine would rocket, and the Amiga market would mature.

Finally I would just like to remind developers out there that *Real 3D 2* running on an Amiga 4000 is so much more versatile and faster than Autodesk's *3D Studio* – even running on a 486 DX2 PC – that the two don't even bear comparison.

Nathan White, Walsall

Your assumption that people started buying 486 PCs just because games like *Wing Commander* started appearing is simply untrue. Similarly, you overestimate the number of Amiga 4000s in circulation. Since its launch in 1992, Commodore have sold just 8,000 units – nowhere near the number needed to support dedicated games software. Since the machine is intended as a professional graphics and presentations workstation, you can hardly expect publishers to fall over themselves in a rush to develop Amiga 4000 versions of their games.

And at £1,850 for an 040 A4000 (without hard drive) it would take more than a few games for hardware sales 'to rocket'.

The console magazine market has been crying out for a quality publication since the demise of ACE. Certainly I, like many others, am fed up of all the puerile nonsense spouted by most other magazines. So why do you on pages 9, 82 and 83 of issue four have blatant and shameless plugs for other Future Publishing magazines? If I wanted to know that Amiga Power rated *Cannon Fodder* an unlikely 94%, then I would buy it.

I realise that such unwanted additions to an otherwise balanced magazine may be out of editorial control, but two pages of grown men getting excited over yet another *Street Fighter II* release sits uncomfortably with the rest of the mag.

On the plus side, I found the relative lack of adverts pleasing, although I suspect that this will change as you deservedly pick up more readers.

G S Moar, West Lothian

While the BBC produces some excellent drama and current affairs programmes, that doesn't preclude it from advertising Noel's House Party, does it?

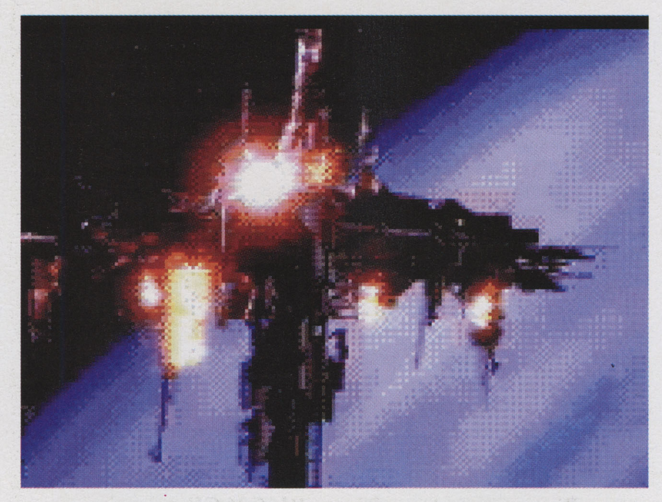
Our sister magazines may be a little less serious, but – after **Edge** – they're still certainly the best places to go for informed reviews on their chosen formats.

Being Super Famicom owners, we are waiting to see what Nintendo's Project reality has to offer, but the fact remains that companies like Sega, Commodore, Panasonic, Atari and Sony are all competing to produce the most impressive machines, specification-wise, without considering what software will be developed in-house and by third party developers to accompany the machine.

It's all very well having FMV onscreen and digital audio CD sound, but these factors count for nothing if the gameplay's not up to scratch. At £50+ for a game, we expect to get our money's worth in the lastability stakes. It seems to us that the programmers are concentrating primarily on graphics and sound and adding the vital gameplay later. *Microcosm* is a perfect example of this. It may well reach the extent where it's just like watching a movie, with no interaction at all. Admittedly some games have both looks and immense playability and depth, but these are few and far between, we think you'll agree.

Are the major competitors just going to keep on producing 64 and even 128bit machines with crap games that feature smart graphics which add realism but consequently destroy the fun, 'unreal' element of videogames, or stick to their guns and produce a library of playable, value for money titles which sell the bloody machine in the end?

Steven Munnoch, Sean Jenkinson, Gloucester



***Ground Zero Texas* on Mega CD. Does the fact that millions of dollars have been spent filming action sequences actually make the game any better? (See letter from Steven Munnoch and Sean Jenkinson)**

It's unlikely that Sony, Sega and Nintendo are failing to consider what software will be available at launch. Just the opposite in fact. All three companies know that software sells hardware and will be doing their damnedest to make sure that there is a good selection of titles ready when their respective machines hit the streets.

Just what form this software will take is anyone's guess: but you can bet the first batches of 32bit titles will be 3D, amazing and expensive.

I've heard a lot about *Virtua Racing* on the Mega Drive – the pictures you printed of it in issue two looked amazing. I'm very much looking forward to it, but given that the cart comes with a DSP inside, I have been wondering just how expensive it is going to be. Are we talking second mortgages here?

James Scudamore, Bristol

Yes, by all accounts *Virtua Racing* really is very good indeed. As well as the standard VR game it also has a split-screen twoplayer mode and instant replay modes.

The DSP chip that the game uses – dubbed the 'Sega Virtual Processor' – runs at 27MHz and can generate around 4,000 polygons per second.

However, it's power at a price: the cart will be sold in the US for $100, and the latest rumour is that it'll cost around £80 and more likely £100 when it hits UK stores around late Spring. And you can play an awful lot of games in the arcades for that sort of money…



Amiga 4000 – at £1,850 for the 040 version, it's not exactly your every day plug-in-and-play games machine (See letter from Nathan White)

questiontime



Puzzled by the profusion of new technology? Drop a line to **Edge** and we'll do our best to provide an answer to all your questions…

Q I am planning to buy the Atari Jaguar when it is released in this country.
1. Will it be Scart compatible or will all UK versions only work on the PAL System?
2. And will it work on most standard colour monitors?
3. The official UK versions of the SNES and the Mega Drive run at 50Hz, while the imported versions run at 60Hz. Will the UK Jaguar suffer the same fate?
4. Will the UK Jaguar have a letterbox display like the UK SNES and Mega Drive?
5. If there is a speed difference between the UK and imported Jaguars, how exactly will Atari's single cartridge for the world policy work?

Howard Wright, Kent

A **1.** The first shipment of UK PAL Jaguars came equipped with RF cables for standard connection to a TV's aerial socket. However, the connector at the back of the machine does support S-Video, RGB and Composite outputs.
2. Yes, with the right connection lead, although you might have to wait a while for these to become available.
3. Yes, while many modern TVs can display a 60Hz signal (usually through the Scart socket), the UK Jaguar is configured to run at 50Hz, or 17% slower. However, many games won't be noticeably affected. *Cybermorph*, for example, runs only 3-4% slower on the UK Jaguar, not 17% slower. This isn't because of the 50Hz video display – the game update runs independently of that – but it's a result of having to display more lines onscreen (PAL has more lines than NTSC), and hence using a bigger screen display which takes up a bit more processing power. The video update and game screen update are separate entities, but the closer the game gets to running in one frame (60 times a second in the US) the harder it is to compensate for the reduction in speed. So, some shoot 'em ups and platform games might appear to run slower on the UK console, while 3D games like *Cybermorph* and *Alien vs Predator* will be hard to distinguish.
4. No, Atari have been wise enough to ensure that games running on the UK machine will operate, wherever possible, with a full screen. Negligible borders should only be the result of the increased numbers of lines on the PAL TV system.
5. It works like this: all future Jaguar cartridges will be programmed to work on both NTSC (US) and PAL (UK) machines. When the cartridge is plugged in it detects what machine it's running on and then uses the video display code relevant to that machine. Only a few lines of code are needed, too.

Just how good is the UK Jaguar? After years of relying on imported systems some players are sceptical. (See letter from Howard Wright)

Q In **Edge** 4, the programmers working on *Alien vs Predator* for the Jaguar complained about being restricted to two megabytes per cartridge. **Edge** two claims that a Jaguar cartridge can hold 400 megabits (50 megabytes) of data. So how are they restricted?

Benjamin Foster, South Shields

A It all depends on what you're compressing. UK Jaguar developers Rebellion claim they can get data compressed up to about 7:1 without the quality suffering. That's about 14 megabytes (112 megabits). Even with this amount of space, detailed 16 or 24bit colour images eat up space far quicker than the 8bit colour ones do on the SNES or Mega Drive.

Q After reading your feature on the Supergun in issue three, I'd like to know if the Supergun will run on my own television. The article said the system runs at 60Hz but I have a 50Hz TV (it says on the back) that also runs NTSC and various other signals. Will it work?

Mark Walker, Derby

A If your TV can run NTSC then it's automatically configured to cope with a 60Hz signal, and should have no problems running the Supergun. Most PAL TVs have 50Hz printed on the back because that's the standard refresh rate of the PAL system. But many modern PAL TVs also include a Scart socket that can receive a 60Hz RGB signal (but not NTSC).

Unfortunately, at the moment this 60Hz compatibility seems to be a feature that manufacturers don't like to advertise, and inquiring in high street TV shops will usually result in blank faces all round!



CD-i can't keep up with newer technology when it comes to shifting CPU-generated graphics. It looks like Digital Video might be its saviour



Samurai Shodown – all 118 megabits of it – and when you think the whole game could probably be crammed onto a 40-50 megabit cart...

Q **1.** Is CD-i 16bit or 32bit, and how does it stand up to generating its own graphics as opposed to streaming them off CD?
2. Do decent games like *The 7th Guest* require the FMV cart or is this now built into the new CD-i machine?

Tony Churcher, W Sussex

A **1.** It's 16 bit, and its CPU, a 68070, runs at around twice the speed of an Amiga. For generating real-time graphics it's not particularly fast, but it is good at handling static colour screens.
2. Yes, 'decent games' like *The 7th Guest* do require the Digital Video cart, and this is only available as an optional extra at the moment.

Q A lack of RAM seems to be posing a problem for the Mega CD. Couldn't the cartridge port of the Mega Drive be used for accepting an additional RAM cartridge?

Nigel Murphy, Surrey

A There is a RAM cart available for the Mega CD in Japan but it's extra SRAM for saving game positions and high scores, and doesn't boost the amount of available main RAM. Technically, 6 megabits don't pose that much of a problem for the Mega CD, but Sega might introduce a RAM cartridge if enough developers complain. Remember though, the PC Engine's Super CD ROM^2 system has managed for a while with a measly 2 megabits – and look at the quality of the games.

Q Congratulations on yet another brilliant issue. Even though I've read all your issues I'm still confused on whether to buy a CD^{32} or a Jaguar. Any thoughts?

Anthony Fleck, Middlesex

A Jaguar's hardware specifications cast a considerable shadow over Commodore's AGA (A1200) chips, but there's currently only one game worth having, and that's included with the machine. However, the Jaguar currently has a better chance of getting software that's been written specifically for it (although one or two launch titles contest that). All the CD^{32}'s getting at present is shovelware – games ported over from the A500 and enhanced with CD music and, if you're lucky, a few more colours.

Sit on the fence for a while if you're unwilling to risk your cash. If you let the software market for each system develop a bit, you may find that your decision becomes easier.

Q I have a Neo-Geo and one thing that's never been properly explained is the way the machine uses high memory cartridges. Is it true that Neo-Geo games are measured in megabytes, rather than in megabits? If so, why do games need to use so much memory?

David Cholm, Essex

A SNK have gone on record several times saying that Neo-Geo games are measured in megabytes instead of megabits, but **Edge** isn't convinced. It's ludicrous to think that SNK could produce a 150 megabyte cartridge (that's 1,200 megabits!) for under £200. Considering that 4 megabits of ROM currently costs well over £1, a 150 megabyte cartridge would cost SNK well over £300 in ROM costs alone!

Neo-Geo programmers are encouraged to waste memory, and you only have to look back at the first two games that appeared for the system – *Magician Lord* and *Nam '75* – to see the evidence. Both these games appeared on 46 meg carts and contain far more graphics and speech than recent 100 meg-plus games like *Samurai Shodown*. How do SNK explain that?

Q What is CinePak? And will the Mega CD need a cart to use it?

Tim Piney, Gloucester

A CinePak is software compression technology for streaming video off a CD. Unlike MPEG, no additional hardware is needed but the quality is inferior. It can handle 32,000 colours on the 3DO and, apparently, up to 512 on the Mega CD.



Thrill to that processing power... go weak at the knees about all those colours... and then snigger a bit about that horrible plastic lid

Q and A

As the world of videogames gets ever more complicated, it's reassuring to know you can count on Edge. Send your queries to: Q&A, Edge, 30 Monmouth Street, Bath, Avon BA1 2BW. You can fax us on 0225 338236, or e-mail us via future@cix.compulink.co.uk. with a subject line 'ATTN: Steve Jarratt'. Sorry, Edge cannot answer *any* questions over the phone and personal replies are not possible.

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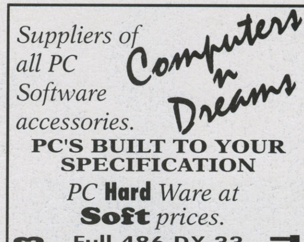
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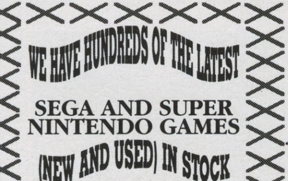
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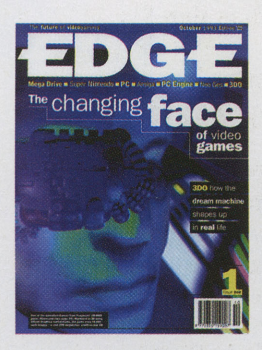
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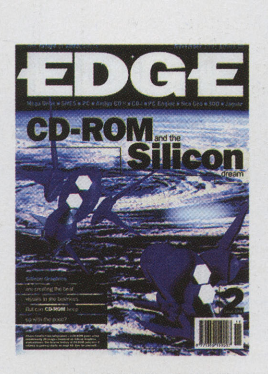
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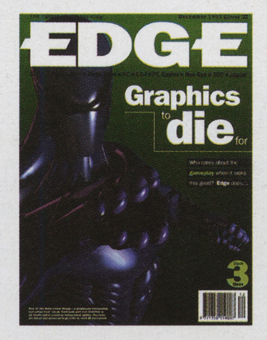
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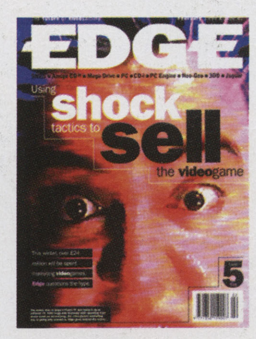
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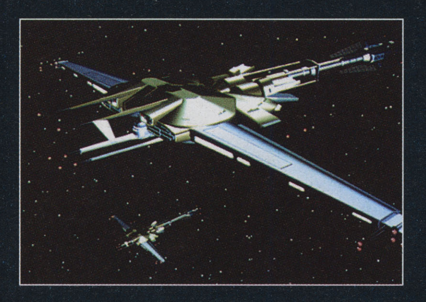
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